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(For Crops other than Herbage)

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TABLE OF CONTENTS.

	PAGE
519 Statistics* (Empire)	1
(Foreign)	25
575 Genetics*	25
576.12 Evolution	28
576.16 Origin of Species, etc.	1
576.3 Cytology* (Empire)	1
(Foreign)	29
58 Botany*	30
631.421 Field Tests* (Empire)	1
(Foreign)	31
632 Plant Diseases* (Empire)	2
(Foreign)	31
633 Economic Plants (Empire)	3
(Foreign)	33
633.1 Cereals (Empire)	4
(Foreign)	36
633.11 Wheat (Empire)	5
(Foreign)	36
633.13 Oats (Empire)	9
(Foreign)	49
633.14 Rye	51
633.15 Maize (Empire)	11
(Foreign)	52
633.16 Barley (Empire)	11
(Foreign)	57
633.17 Millets and Sorghums (Empire)	13
(Foreign)	58
633.18 Rice (Empire)	14
(Foreign)	58
633.4 Roots and Tubers (Empire)	16
(Foreign)	59
633.5 Fibres (Empire)	17
(Foreign)	62
633.6 Sugar Plants (Empire)	20
(Foreign)	66
633.7 Stimulants (Empire)	21
(Foreign)	68
633.81/4 Aromatic Plants, Spices, etc.	72
633.85 Oil Plants (Empire)	22
(Foreign)	73
633.88 Medicinal Plants	75
633.9 Rubber Plants	75
634 Fruit Trees (Empire)	22
(Foreign)	76
634.9 Forestry (Empire)	23
(Foreign)	87
635 Vegetables (Empire)	24
(Foreign)	89
Book Reviews	98

Note.—Initialled abstracts are written by the following :

Dr. H. Martin Leake	...	H. M. L.
Dr. B. P. Pal	...	B. P. P.
Dr. J. Wishart	...	J. W.

* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VI, No. I.

Part I. British Empire

STATISTICS 519

1. RAJABHOOSHANAM, D. S. 519.24:631.421
Application of modern statistical methods to yield trials (Woodhouse Memorial Prize Essay, 1933).
Agric. Live-Stk. India. 1935 : 5 : 145-55.

An account of modern experimental methods with their statistical analysis.

J. W.

ORIGIN OF SPECIES, ETC. 576.16

2. GREGOR, J. W. and HORNE, F. R. 576.16:633
Growth forms : genecology and its agricultural significance.
Agric. Progr. 1935 : 12 : 89-98.

The agencies bringing about differentiation in wild organisms are ecological factors, influencing the genotype selectively ; geographical, producing their effect by isolation ; and, not unlike the latter in some respects, cytological ; these together with mutations, produce the different types of taxonomic units which various workers have suggested, such as ecotypes and geo-ecotypes. In agriculture, agencies similar but more conscious in operation are at work in the production of the minor crop units, and the results should be greatly improved if, in registering strains and varieties, the possibilities of variations are considered. It is suggested that the original stock should be carefully described, both quantitatively and qualitatively, and seed should be periodically tested, under uniform conditions, for its approximation to the original type, the work being carried out cooperatively by the existing agricultural institutes.

CYTOLOGY 576.3

3. DARLINGTON, C. D. 576.312(001.4)
576.312.3
The old terminology and the new analysis of chromosome behaviour.
Ann. Bot. Lond. 1935 : 49 : 579-86.

As a result, the author states, of the older cytologists' methods of applying the same principles to cytology as to histology, with equal certainty, and of basing conclusions on observations without considering whether the observations were consistent with similar observations, or the conclusions with every other relevant conclusion, an elaborate terminology has been built up containing numerous terms of doubtful significance. He appeals for the use of more logical methods, using all relevant information from both genetics and cytology, and illustrates his methods by examining certain problems of chromosome structure, viz. the theory of the pre-resting stage split, of the reticulum in the resting nucleus, and of the chromonema and matrix in metaphase chromosomes, and shewing that the chromosomes are single when the nucleus enters the resting stage, and that the reticulum found in fixed resting nuclei is a non-characteristic artefact, while the concept of the chromosome matrix is, he concludes, a myth.

FIELD TESTS 631.421

4. EDEN, T. 631.421:519.24
The development of field experiments in agricultural research.
Trop. Agriculturist 1935 : 84 : 63-69, 131-49, 188-95.

A critical review of the history of field experimentation and the development of the modern scientific methods. The first exact experiments are traced back to Boussingault in Alsace a hundred years ago. A discussion of the Rothamsted experiments of Lawes and Gilbert is succeeded by a description of the way in which the theory of probability was brought to bear on the problems at issue. American developments are outlined, and the author then concentrates

on the improvements effected by "Student" and Fisher, and describes in detail those methods based on the analysis of variance that have in recent years become familiar to experimenters. In discussing the future field experiments the author says "it is imperative to consider whether modern field experimental technique is a mere flash in the pan, destined to be discarded, or at any rate severely discounted. Our contention is that it is not . . . the place of field experiments in agricultural research seems assured."

J. W.

PLANT DISEASES 632

5. POPP, W. and HANNA, W. F.
Studies on the physiology of the oat smuts.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : p. 255.
 Abstract of paper already reviewed (see "Plant Breeding Abstracts," Vol. V, Abst. 851).

632.451.2:576.16:575.12:633.13
 632.451.2:575.11:633.13
6. HANNA, W. F.
The physiology of the fungi causing bunt of wheat.
 Proc. 5th Pacif. Sci. Congr. Canada 1934 : 4 : 3195-3204.
 Though bunt infection (by *Tilletia tritici* or *T. laevis*) is dependent on a number of environmental factors, notably soil temperature, it also depends on the physiological form to which the inoculum belongs. It is probable that few of the physiological forms so far discovered are pure lines. If they are mechanical mixtures of different races their purification by passing through a particular host ought to be fairly simple, but should they prove to be heterozygous this will be a lengthy process. Other characteristics which vary in different physiological forms include the morphology of the affected host, trimethylamine content of the spores (the disagreeable smell), reaction with artificial media, and the optimum temperature for spore germination and infection.
 Studies of spore germination on artificial media have shown that the time of germination and the number of sporidia produced (4-21, average 11.1) depend on the temperature and the physiological form.
 Earlier reports of heterothallism in these fungi were confirmed (see "Plant Breeding Abstracts," Vol. II, Abst. 600). No clear evidence was obtained however that there were more than two sex groups. By inoculation with a mycelium of *T. tritici* from a single sporidium or secondary conidium and a similar mycelium of opposite sex of *T. laevis*, a hybrid between the two species was obtained, which resembled *T. laevis* in its rounded bunt balls, trimethylamine content, and smooth spores.

632.451.3:576.16:633.11
 632.451.3:577.8:575.127.2
7. JOHNSON, T. and NEWTON, M.
Hybridization between *Puccinia graminis tritici* and *Puccinia graminis avenae*.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 219-23.
 Of thirteen haploid pustules of *P. graminis avenae* form 6 to which pycniospore-containing nectar of haploid pustules of *P. graminis tritici* forms 36, 11 or 9 was applied, one produced aecia, which however failed to infect either wheat or oats. In the reciprocal crosses one out of 19 haploid pustules of *P. graminis tritici* produced aecia and these picked off singly caused infection on both Victory oats and Little Club wheat, six cultures being obtained. The latter were then used to test the pathogenicity of the hybrid on different hosts.
 The hybrid was found to have the ability to infect certain of the hosts of each parent, but only to a limited extent, its pathogenicity being less both in range and in virulence.

632.452:575.12:633.11
 632.452:575.12:633.13

8. WATERHOUSE, W. L. 632.452:576.16:633.11
Australian rust studies. V. On the occurrence of a new physiologic form of wheat stem rust in New South Wales.
 Proc. Linn. Soc. N.S.W. 1935 : 60 : Parts 1-2 : 71-73.

Wheat has been found for the first time in New South Wales attacked by form 11 of *Puccinia graminis tritici* E. and H., in combination with form 34, the most widespread form. It is significant that form 11 is one which has been derived from barberries infected in the plant house with form 34 (which is heterozygous), and that naturally infected barberries were recorded in 1934 for the first time in New South Wales where form 34 was present on gramineous hosts.

ECONOMIC PLANTS 633

9. BRINK, R. A. 635.656-2.484-1.521.6:575
The significance of certain concepts in genetics for plant breeding.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 15-19.

Plant breeding dates from the middle of last century, so that the new science of genetics, beginning in 1900, met with recognition from its birth, and its development since that time has provided a firm foundation for plant breeders. The chromosome theory of heredity, the distinction between genotype and phenotype, and the pure line were ideas of the greatest importance in practical breeding work.

The immensely complex make-up of the germplasm of the plant make the step by step synthesis of a required form an impossible task, especially since the genes affecting qualities of economic importance are usually numerous and individually indistinguishable by their small effects.

In some cases, however, pure Mendelian analysis has proved to have a direct application and the author cites the discovery of a single gene for wilt resistance in peas which may be claimed to have saved the canning industry.

10. SHAW, F. J. F. 633:575(54)
Indian agriculture and plant breeding.
 Agric. Live-Stk. India 1935 ; 5 : 109-14.

A general review of Indian plant breeding work.

The breeding of disease-resistant forms is of comparatively recent development in India. Notable success has been achieved in this direction with pigeon peas (*Cajanus indicus*) in which, owing to the absence of linkage between the three or more factors for resistance to *Fusarium* wilt and morphological characters, workers at Pusa have been able to evolve resistant forms morphologically identical with susceptible forms. The breeding of rust-resistant wheats is also in progress.

Pusa 111 and Pusa 114 are mentioned as two valuable achievements of wheat breeders in India, the first being a high quality wheat equal to the best Manitoba wheat for bread making, while the latter, of almost equal quality has the added advantage of being disease resistant.

Following the tariff preferences awarded to Indian vegetable oils and oil seed in the United Kingdom, work is being carried out on the improvement of oil seeds, especially in linseed. The demand in this crop is for a white or yellow "bold" seed. The genetics of flower colour have been worked out, and it is hoped to produce a form recessive in all the factors for flower colour and hence for seed colour, while crosses have been made between the small seeded types which flourish in the Gangetic alluvium and the large seeded types of Peninsular India, in the hope of producing a large seeded type to suit Northern India.

A scheme of research and breeding in potatoes has been drawn up, involving study and classification of varieties grown in India, crossing with South American forms to procure resistance to blight, virus disease and so on, study of flowering and fruit development, and studies on the possibility of breaking the dormancy of the tuber by chemical or mechanical treatments.

The most interesting work on sugar cane has been the cross with sorghum ; one such hybrid, Co. 352, appears promising from an economic point of view, ripening in 6-7 months and maintaining its juice for another 3 months.

In conclusion the need for cytological investigations as an adjunct to plant breeding is stressed.

11. CHEESMAN, E. E. 633:575.1
Contributions of botany to tropical agriculture.
 Trop. Agriculture, Trin. 1935 : 12 : 201-04.

The importance of plant genetics to agriculture is evident, but the more specifically botanical activities of the collection, introduction, comparison and classification of species and varieties of crop plants are shewn to be equally essential.

Attention is also directed to the existence of varied problems in the selection of the "best" types, in hybridization work and in the necessary chemical and physiological investigations involved therein.

12. AAMODT, O. S. 633-2.112-1.521.6:578.081
 633.11-2.112-1.521.6
A machine for testing the resistance of plants to injury by atmospheric drought.
 Canad. J. Res. 1935 : 12 : 788-95.

An account of the mechanism and working of the "chinook" machine and its probable use in differentiating resistant and non-resistant varieties and hybrids and in allied problems. A full-page illustration of the apparatus is given.

13. NEATBY, K. W. 633-2.452-1.521.6:575
Recent advances in plant breeding for disease resistance, with special reference to the rust problem.
 Trans. Brit. Mycol. Soc. 1934 : 18 : p. 347.

A brief report of a paper read at British Mycological Society, November 1933.

CEREALS 633.1

633.1:575:581.143.26.035.1(94.5)
 633.11:581.143.26.035.1
 633.16:581.143.26.035.1
 633.1:581.481:575

14. RAW, A. R.
A practical application of photoperiodic response to plant breeding methods at the State Research Farm, Werribee.
 Proc. Roy. Soc. Vict. 1934 : 46 : (N.S.) 131-38.

On the methods adopted at the Victorian State Research Farm, Werribee to obtain two generations of wheat and barley hybrid material in twelve months by subjecting the plants to artificial illumination to increase the length of day.

Though this technique is regarded as of definite value in special cases the disadvantage of having to harvest the plants in an immature condition is pointed out. Moreover only the production of the early generations can be accelerated in this way as selection of desired types could not be made in the artificial experimental environment.

Twin grains and branching stems were produced by some of the plants raised but neither character was inherited.

15. ENGLEADOW, F. L. 633.1-1.557:575
The problem of cereal yield.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 9-15.

The problem of increasing yield is becoming progressively more difficult, and scientific studies on the topic are needed. Yield, the end-product of the plant's activities, is affected by every aspect of the plant's development, and is due to the interaction of a number of external and internal factors. Developmental studies rather than studies confined to the mature plant are needed if the exact nature of the effect of the various factors is to be understood.

The internal factors are of importance in relation to plant breeding. At present the latter is more of an art than a science, depending to a great extent on eye judgment. In the attempt to make plant breeding more scientific correlations have been sought between yield and various morphological characters, but this line of attack has failed to produce anything which might

be regarded as a "yield-index." Another more ambitious conception of the scientific development of plant breeding consists in the analysis of the internal factors affecting yield followed by the purposeful synthesis of these factors from whatever existing varieties contain them. At first attention would need to be restricted to the more important points, such as tillering and size of ear, and moreover should be limited to one cereal.

Disappointment has often been expressed as to the small contribution which genetics has made to practical breeding, but the author points out that this is rather due to ignorance of the nature of the biological factors affecting yield than to the limitations of genetical knowledge, thus again deriving the moral that developmental studies of the internal factors are needed. Among the special phenomena of genetics which have affected plant breeding are mentioned the production of stable hybrids from two or more species of diverse genetic constitution, and the application of hybrid vigour. The latter, it is suggested, may yet find an application among the small grain cereals, there being some evidence that heterozygosity imparts added vigour even in these normally self-fertilized plants.

633.1-2-1.521.6:575(67.62)
632:576.16:633.1(67.62)

16. THOROLD, C. A.
Diseases of cereal crops in Kenya Colony.
Bull. Dep. Agric. Kenya 1935 : No. 2 : Pp. 66.

In this partially illustrated account, which is intended to enable farmers to recognize diseases in the field and estimate their importance and the necessity for future precautions, the various maladies are grouped under their hosts. Questions of breeding resistant types, physiological forms and points of interest from the relevant literature are briefly referred to as they arise. Many of the references in the bibliographical notes have been reviewed from time to time in "Plant Breeding Abstracts."

WHEAT 633.11

17. RAM DHAN SINGH, C.
C.591. A new, high quality, productive wheat.
Seasonal Notes Punjab Agric. Dep. 1935 : 13 : 19-20.

633.11 C.591(54.5)
633.11:575

This new hybrid variety (produced by the Agricultural Department of the Punjab) combines excellent quality with good yield. It is an amber, bold grained, bearded wheat with rather dense ears which have a white, somewhat densely felted chaff and greyish awns. Its straw is long but fairly stiff and it is early, erect and quick growing. It is very resistant to all the rusts. The grains, which are much less subject to mottling, approach more closely to the ideal shape than other high yielding varieties.

18. SHAW, F. J. F.
Wheat and barley in India.

633.11:575(54)
633.16:575(54)

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 55-60.

An account of the improvements which have been made in wheat and barley in India. In wheat, Pusa 4 and Pusa 12 (high yielding and "hard" wheats in comparison with local forms) held a pre-eminent position for many years, but latterly higher quality wheats with high yielding capacity have been introduced and are rapidly extending in cultivation. Barley is largely used for feeding purposes and mostly belongs to the six-rowed *Hordeum vulgare* L. form, but at Pusa two-rowed types suitable for malting are being produced, while in the Punjab Type 4 (Rewari) and Type 5 (Lyallpur) have secured very high reports for malting and brewing.

In conclusion it is pointed out that India is capable of producing wheats and barleys which can compete in quality with those from any part of the world.

19. MORRIS, G. P. 633.11:575(62)
A note on wheat growing in Egypt with special reference to the breeding work carried out by the Botanical Section of the Ministry of Agriculture.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 19-22.

The native wheats are mainly *dicoccum* types and quite unlike other known forms. In Upper Egypt some *durum* wheats are grown and recently Indian (Hindi) types (awned *T. vulgare*) have been introduced and have proved popular. Breeding work in wheat dates from the establishment of the Cereal Sub-Section in 1921 and the work consists of variety trials and purification and selection of Egyptian and imported wheats, the production of new varieties by hybridization, observation of rust and other diseases, milling and baking tests and chemical analysis, and bulk propagation of the most promising strains.

The methods of selection and testing pure lines and hybrid lines are described. The rusts affecting wheat in Egypt are *Puccinia glumarum*, especially on native wheat (*T. pyramidale* Perc.), *P. graminis*, especially on Indian types, and *P. triticea* which along with *P. graminis* affects most of the imported varieties.

Strong wheats can be grown in Egypt, but the problem is to produce a high yielding strain. "Re-selected Hindi D" combines a very heavy yield with very fair quality grain and has been distributed by the Ministry of Agriculture.

20. HOWARD, A. 633.11:575(71)
Some possible improvements in Canadian wheat.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 50-51.

The author suggests that when the time comes to extend the wheat growing area further north in Canada, the growing period could be shortened by hybridization with Indian wheats, forms of which can be found which are very early maturing. Forms have also been discovered and grown at Pusa which were resistant to all three rusts occurring in India (*P. triticea* Eriks., *P. glumarum* Eriks. and Henn., and *P. graminis* Pers.), and these would also be of great utility in improving Canadian wheat.

21. STRAMPELLI, N. 633.11:575"793"(45)
 633.11:575(45)
Early ripening wheats and the advance of Italian wheat culture.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 53-54. (Abst.)

An English abstract of a paper already reviewed (see "Plant Breeding Abstracts," Vol. V, Abst. 305).

22. FRASER, J. G. C. and GFELLER, F. 633.11:575.12:578.081
 633.11:575:578.088.1
Two new methods of distinguishing certain Canadian wheats.

Sci. Agric. 1935 : 15 : 564-72.

The distinctive reactions to phenol of the grain and ears of a number of Canadian Hard Red spring wheats are recorded ; and it is believed that the phenol test could be used to differentiate between morphologically similar varieties and in certain cases to detect hybrids. Immature grains did not give a true varietal colour reaction.

By soaking the grains in water for 16 hours to accentuate the visible outline of the germ it was possible to identify Garnet from all other Canadian wheats by the length of germ and the depth of the grain. The phenol colour reaction too accentuates the brush characters and was useful in separating Marquis from a Garnet and Reward mixture.

It is claimed that the data here recorded should aid the plant breeder in establishing the genetic composition of hybrids, in identifying pure lines and in classification.

23. OEHLER, E. 633.11:575.127
The utilization of genus and species crosses in breeding new varieties of wheat.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 51-53.

An English summary of a paper already reviewed (see "Plant Breeding Abstracts," Vol. V, Abst. 308).

24. 633.11:575.242:576.356.7
 633.13:575.242:576.356.7
 HUSKINS, C. L.
The origin and significance of fatuoids, speltoids, and other aberrant forms of oats and wheat.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 45-50.

Fatuoids in oats, speltoids in wheat and many other aberrant forms can be explained in terms of chromosomal irregularities. Three main series of fatuoids and speltoids may be distinguished according to their breeding behaviour.

Series B is the simplest type. Heterozygous fatuoids or speltoids in this series have 41 chromosomes instead of 42, forming $20n + 1$ at meiosis, and give heterozygous and normal progeny in the ratio 5 : 1 approximately on selfing, the exact ratio depending on the distribution of the univalent at meiosis. A few 40 chromosome (homozygous fatuoid) types are also produced; these are sterile dwarfs and shew a great reduction in pairing. Presumably the missing chromosome carries factors for normal characteristics to which the fatuoid characteristics are usually hypostatic, and also factors necessary for normal meiotic behaviour. Female germ cells carrying 20 or 21 chromosomes function normally, but 20 chromosome pollen grains only rarely effect fertilization, hence the small number of 40 chromosome types and the correspondence between the ratio of heterozygous fatuoids : normal and the distribution of the unpaired chromosome at meiosis.

The next simplest type is found in Series C. Here heterozygous fatuoids give progeny like themselves and normals in approximately equal proportions. The homozygous fatuoids of which from 2 per cent to 20 per cent are produced vary in size and fertility and when they are numerous, relatively large and fertile, strains of Series C approach the type of Series A. In typical forms of this series, the heterozygous fatuoids have 43 and the homozygous 44 chromosomes, the extra chromosome being one carrying factors for the "wild" type (chromosome B). Other forms in this series, however, were found not to have an extra chromosome, but to lack part of one. In this case it seems that the part lost is part of the chromosome which is entirely lacking in Series B (chromosome C), the part not lost carrying the factors necessary for chromosome pairing.

Series A includes most of the homozygous fatuoids found in commercial varieties of oats, since only in this series are the homozygotes comparable in vigour and viability to normal oats.

Series A heterozygotes typically give 1 : 2 : 1 ratios of normal plants, heterozygous and homozygous fatuoids respectively. All classes of segregates have the normal number of chromosomes but trivalents and quadrivalents are frequently found. It was at first thought that there the C chromosome had been lost and the B chromosome duplicated in the heterozygotes. This was disproved by genetical tests, and it now appears that a small part of chromosome B has been duplicated and a small part of chromosome C deleted, owing to irregular pairing between chromosomes B and C.

Other peculiar fatuoid and speltoid types may occur and some of these are described.

If the 7 pairs of chromosomes in the most primitive oat and wheat species are designated

1, 2, 3, 4, 5, 6, 7 then in normal *A. sativa*, *T. vulgare* etc. we have $1_A 1_B 1_C$, $2_A 2_B 2_C$, etc.

1, 2, 3, 4, 5, 6, 7 $1_A 1_B 1_C$, $2_A 2_B 2_C$, etc.

There is evidence that the factors distinguishing *A. sativa* from *A. fatua* are located in only one of these sets of 6 chromosomes, so that we may call the chromosomes under consideration ABC.

ABC

Normally these form bivalents AA, BB and CC, at meiosis, but occasionally trivalents or quadrivalents are formed, even in normal varieties, shewing that other combinations are possible. Following pairing between B and C, crossing-over will result in B acquiring a part of C and a heterozygous fatuoid will arise in the next generation if the part concerned includes the factors

determining fatuoid *vs* normal characteristics. Further, owing to a B chromosome carrying a part homologous with C, multivalent formations will occur in succeeding generations more frequently than in normal strains and the normals segregating from heterozygous fatuoids will produce fatuoid mutants more frequently than original normals, which is borne out by genetic records.

The author considers that Jones's theory of the origin of fatuoids of series A by gene mutations, involving as it does simultaneous mutation in a whole series of genes, is the least plausible of any explanation yet given.

25. 633.11-2.4-1.521.6:575
AAMODT, O. S. and KILDUFF, T. 633.11-2.451.3-1.521.6:575

Breeding wheat for resistance to disease with particular reference to bunt.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 43-44.

Smut and foot rot are the most important diseases of wheat in Alberta, rusts being comparatively infrequent in occurrence. Bunt causes considerably more losses than loose smut and the production of commercially desirable bunt-resistant varieties is one of the aims in the plant breeding programme.

Four bunt-resistant varieties with desirable agronomic characters have given good results in tests and one of them, Canus, from a Kanred-Marquis cross, is to be increased for distribution.

26. GOULDEN, C. H. 633.11-2.452-1.521.6:575
Breeding disease resistant varieties of wheat.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 29-37.

Resistance to stem rust is now divided into two distinct types, physiological resistance, based on the seedling resistance to different physiological forms, and mature plant resistance, which does not appear until the plant is half grown and which applies equally to all forms of the fungus. The breeding of forms combining physiological resistance to all known forms of the fungus is a problem of great complexity, though somewhat simplified by the fact that resistance to a whole group of forms is often governed by a single factor. Mature plant resistance holds out more hope for breeding resistant plants as its inheritance is simpler and the multiplicity of physiological forms is not a factor.

Other points to be considered are the associations of disease resistance factors among themselves and with agronomic characters, and such have been found in practice, though they may not always be genetic associations. It seems for example, that the association between resistance to stem rust and susceptibility to black chaff is a physiological one, i.e. rusted wheats do not develop black chaff.

In conclusion, the author gives details of the performance of four disease resistant lines of wheat and compares them with Reward and Marquis. Certain of the lines are resistant to a number of diseases, and yet compare very favourably with Marquis in yield, earliness, strength of straw and baking quality.

27. CLARK, J. A. 633.11-2.452-1.521.6:575
633.11-2.451.3-1.521.6:575

Inheritance of stem rust and bunt reactions in spring wheat crosses.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 37-43.

There are three types of reaction to stem rust (*Puccinia graminis tritici* Eriks. and Henn.) and bunt (*Tilletia tritici* (Bjerk.) Wint. or *T. levis* Kuehn.), viz. susceptibility, resistance, and near-immunity. Susceptibility is the commonest reaction and is usually dominant to resistance; near-immunity on the other hand, is dominant and usually inherited in a simple Mendelian way, as in Hope or H-44 where it is due to a single factor. The near-immune reaction to stem rust in this case was derived from Yaroslav emmer wheat, and recent work suggests that in emmer there are three dominant factors for near-immunity. Resistance may be seedling resistance or

mature plant resistance and it is the latter type which is being used more and more in plant breeding.

Although in some crosses the inherited reactions may be clear-cut and controlled by only one or two genetic factors, in others there may be no clear-cut differences, the inheritance being due to many factors, differing in amount of effect. The effects of minor and modifying factors cannot always be distinguished from environmental effects.

The author illustrates his remarks with numerous examples from wheat-breeding work, most of which have been dealt with individually in "Plant Breeding Abstracts."

28. PAL, B. P. 633.11-2.452-1.521.6:575

Wheat rusts from the viewpoint of plant breeding.

Agric. Live-Stk. India 1935 : 5 : 139-44.

The factors complicating the problem of breeding rust-resistant forms are the occurrence of numerous physiological forms of the fungi and the fact that the wheats resistant to most rusts belong to the emmer group and do not cross readily with *vulgare* wheats. On the other hand, more hopeful features are mature plant resistance and the fact that resistance to a number of physiological forms is often governed by a single factor.

The breeding of such rust-resistant forms as Marquillo, Hope, H-44-24, and the Marquis Pentad hybrid from crosses between emmer or *durum* wheats and *vulgare* wheats is mentioned. In India, although the number of physiological forms of the three species of rust (black, brown and yellow) is small, no native wheat is known which is resistant to all forms, and so hybridization will have to be applied. In the case of black rust no *vulgare* wheat is known which is resistant to the Indian physiological forms, and Khapli, the variety of emmer wheat which possesses the greatest degree of resistance, does not hybridize readily with *vulgare* wheats ; it may be necessary therefore to cross this wheat with a *durum* variety and then use a resistant *durum* segregate in the cross with a *vulgare* variety. On the other hand the utilization of the mature resistance of certain *vulgare* varieties may be a more promising line of attack.

29. PELSSENKE, P. 633.11:664.641.016:575.11

The inheritance of the gluten quality of wheat.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 434-38.

In respect of the baking value of wheat, the plant breeder has to concentrate on gluten characteristics. Tables are given of the results of baking tests, fermentation tests and swelling tests on different wheats.

In hybrids between wheats with different gluten characteristics, high gluten quality is recessive, but it is not known how many factors are involved (see "Plant Breeding Abstracts," Vol. III, Abst. 391).

30. ANDRONESCU, D. 633.11:664.641.016:575.42(49.8)

Roumanian wheats, their milling and baking qualities.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 413-18.

The varieties of wheat grown in Rumania are *Triticum vulgare erythrospermum* and *T. vulgare ferrugineum*, the former having the more vitreous kernel and higher yield. The varieties, however are rarely found to be pure, and a number of pure line selections with superior milling and baking qualities are being tested.

Yields, analyses, and results of baking tests are given for wheat grown on different types of soil.

OATS 633.13

31. ROBB, W. 633.13:575.182.061.633

Inheritance in oats, with special reference to striped leaves.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 84-88.

Oat plants were discovered with yellow stripes on the leaves, varying in width, number and extent. In crosses with normal plants, the character was only transmitted through the female parent, and since the F_2 ratios were very variable, it is concluded that the inheritance is purely maternal, depending on the character of the plastids.

32. JONES, E. T. 633.13-1.44:575
Observations on yield trials and varieties of spring sown oats in relation to different levels of productivity in Wales.
 Ann. Appl. Biol. 1935 : 22 : 208-24.

Investigations at Aberystwyth and results from certain other trials indicate that the relative merit of oat varieties is to some extent a function of the productivity of the soil; varieties which excel under conditions of high productivity may themselves be excelled both in grain and straw yields under less productive conditions. For instance the variety Record is superior to Radnorshire Sprig and Black Bell III when yields of grain of the order of 23 cwt. per acre are obtained (from Record), by an average difference of 4.5 per cent; at the level of 16.8 cwt. Record is surpassed by 4.5 per cent, while at lower levels the difference in favour of Radnorshire Sprig and Black Bell III becomes even greater.

If the varieties of oats are grouped into grades I, II and III on the basis of the productivity of the conditions for which they are suited, the author considers that Grade II types begin to excel those from Grade I when the level of productivity is between 15 and 20 cwt.

Since the average yield per acre for the whole of Wales is only 11.7 cwts. and since Grades II and III varieties together make up about half the seed sown in the principality, he suggests that there is need for more extended variety trials, particularly for trials at the lower levels of productivity, and on a type basis.

Other plant characters of practical importance in variety trials are discussed, and it is pointed out that their relative importance varies from place to place, e.g. straw stiffness is of primary importance on fertile soils but not on poor soils, and hence it may be advantageous to have a multiplicity of varieties adapted to local needs.

33. HUNTER, H. 633.13-2.111-1.521.6:575
The improvement of winter oats.
 J. Agric. Sci. 1935 : 25 : 419-44.

With the aims of producing a winter variety of oats possessing the resistance to winter conditions and the grain quality (low husk content) of Grey Winter and a better standing straw, the latter variety was crossed with Argentine, a spring variety with superior standing power but somewhat higher husk content.

From the F_3 , single-plant selections of white-grained plants with good standing straw were made and in the F_4 further selecting was performed on a basis of husk determinations and chlorosis, five families being ultimately left. From the progeny of one of these a further series (termed *ex* 109/1) was obtained which had probably arisen from an out-pollination with Grey Winter.

The hybrids exhibited a wide segregation in winter resistance, both between and within families; segregation was also found in respect of husk content, but the variations within families were small as compared with those between families. The range of straw lengths exceeded that of the parents, while in fineness the straws of the hybrid progenies ranged between the parents.

The early growth habit appears to be important in relation to winter resistance, the most resistant selections being prostrate, but the correlation is not absolute. It was also noted that erect and prostrate plants gave erect and prostrate progeny respectively, while semi-erect and semi-prostrate forms shewed segregation.

The selections which most nearly approached the characters aimed at were 109/1 and 109/3 which resemble Grey Winter in winter resistance, husk content and chemical composition of grain, prostrate early habit of growth and tillering capacity; they have a slightly higher thousand grain weight, superior standing power, ripen 7-10 days earlier, and yield tests indicate a superior yield of grain. Another selection, 136/17, has also superior standing power, being shorter in straw than either parent, and produces a small grain with husk content nearer that of Argentine, while its tillering capacity is high.

34. VEARS, C. K. and MACINDOE, S. L. 633.13-2.451-1.521.6:575(94.4)
Oat smut. The reactions of varieties to the disease.
 Agric. Gaz. N.S.W. 1935 : 46 : 187-90.

In lists of oat varieties tested for resistance to smut, promising new varieties such as Lampton (bred from Abruzzes x Victory x Reid) and Frazier (a selection from Fulghum) are mentioned as immune. Susceptible varieties are also enumerated. A number of crosses have been recently made between smut-resistant varieties and others excelling in other characteristics, the crosses in some cases being between parents actually highly resistant to stem rust, crown rust and smut. Promising hybrids are being selected.

MAIZE 633.15

35. **New varieties of maize.** 633.15 :575(68)
 Fmg. S. Afr. 1935 : 10 : pages 276, 292.

A warning against the use of supposedly new varieties of maize that have been insufficiently tested. Many such are merely the result of crosses and may exhibit undesirable characteristics later. This applies particularly to cases in which the hybrid vigour accompanying a newly made cross is frequently responsible for temporary high yielding capacity or drought resistance. Impartial controlled tests and particulars of the origin of new types are essential before they are accepted by growers or breeders.

36. KIESSELBACH, T. A. 633.15:575.125
The possibilities of modern corn breeding.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 92-112.

A comprehensive account of the practical aspect of hybrid corn. After describing the principles and methods of producing the various types of hybrids, the author gives details of their performance in tests in various parts of the U.S.A.

A method which is being tried in Nebraska is the distribution of seeds of two unrelated single crosses to farmers, who then produce the double cross from them.

The costs of producing hybrid seed and the probable gains to be derived are estimated. The author recommends caution in the exploitation of hybrids.

37. CAFFREY, D. J. 633.15-2.7-1.521.6
The European corn borer in the United States.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 544-51.

Inter alia it is stated that differences have been found between varieties and strains in resistance to the European corn borer (*Pyrausta nubilalis* Hbn.) as measured by larval survival per 100 eggs, and also in tolerance, as measured by yield and quality of the crop and breakage of stems in relation to the number of borers per plant.

38. FLINT, W. P. 633.15-2.7-1.521.6:575
The chinch bug as a pest of corn on the American continent.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 552-54.

One of the methods of control of the chinch bug is the growing of resistant varieties, developed by breeding and selection during the last 20 years.

BARLEY 633.16

39. 633.16 Newal
 633.16:575(77.6)
 AAMODT, O. S. and JOHNSTON, W. H. 633.16:581.46:575.061.5
Newal—a promising new smooth-awned variety of barley for Alberta.
 Circ. Coll. Agric. Alberta 1935 : No. 18 : Pp. 19.

The new variety, which is described, was developed from a cross between a white, six-rowed, smooth-awned selection obtained from Minnesota Agricultural Experiment Station and the six-rowed, rough-awned O.A.C. No. 21. Among its characteristics are plump grain and relatively

Fmrs' Bull. Dep. Agric. N.S.W. 1935 : No. 170 : Pp. 20.

Proc. World's Grain Exhib. Conf. Canada 1933: 2: 83-84.

HARRISON, T. J.

Causes of variation in protein content of barley.

Proc. World's Grain Exhib. Conf. Canada 1933: 2: 60-71.

The factors causing variation in protein content are considered as varietal and environmental. The protein content calculated to a 13.5 per cent moisture content, of several varieties is given, the varieties being classified as a six-row Manchurian, six-row Mediterranean, two-row Chevalier and two-row Duckbill types. In the respective classes, the lowest protein content was found in the varieties July, Trebi, Hannchen and Canadian Thorpe. The two-row Chevalier and the six-row Mediterranean types in general were lower in protein than the six-row Manchurian and the two-row Duckbill types.

AAMODT, O. S. and JOHNSTON, W. H.

Smooth-awned barley varieties.

Sci. Agric. 1935 : 15 : 597-606.

AAMODT, O. S. and JOHNSTON, W. H.

Reaction of barley varieties to infection with covered smut (*Ustilago hordei* Pers. K and S).

Canad. J. Res. 1935 : 12 : 590-613.

12

embryo, (2) scarification with sandpaper, (3) sulphuric acid. Untreated grains were also grown and the results from the four types were statistically analysed. All three dehulling methods resulted in significant increases in infection, the greatest increases being in the case of hand-dehulled grain followed by acid-dehulled and then by scarified grain. The greatest reduction in stand resulted from acid-dehulling while scarifying and hand-dehulling gave results intermediate between this and hulled seed. On the whole hand-dehulling is the most reliable method, though very laborious. From the average infection from all treatments the following varieties were considered to shew resistance :—

Six-rowed, hulled types. O.A.C. No. 21, Atlas, Sacramento, Glabron, Velvet, Leiorrhynchum, Wisconsin Barbless No. 38, Shaw, Sol and Success.

Two-rowed, hulled types. Spartan, Golden Pheasant and Horn.

Hulless types. Himalayan, New Era, Russian, Mongolian and Burbank.

In collections of *U. hordei* gathered from six points in central Alberta were found two distinct physiological forms which can be distinguished by their reaction with Eureka and Canadian Thorpe or Hannchen.

MILLETS AND SORGHUMS 633.17

45. Improved Kar Ragies. 633.17:575(54.8)

Mysore Agric. Cal. 1935 : Pages 9, 13, 17.

The selection work on millets at Hunsur before and after the establishment of the Hunsur Breeding Station is referred to. Considerable improvement has been effected in yield of grain and straw, especially from some new strains that have been tested.

46. KRISHNASWAMI, N. and RANGASWAMI AYYANGAR, G. N. 633.171:576.312.35:576.356.5
Chromosome numbers in some *Setaria* species.
 Curr. Sci. 1935 : 3 : 559-60.

From counts at diakinesis and metaphase I, the chromosome numbers of *Setaria italica* Beauv., and *S. verticillata* Beauv. were determined at $n = 9$, with one pair larger than the rest, while in *S. glauca* Beauv. $n = 18$ was found, with two larger pairs. Secondary pairing was found in *S. glauca* and it is suggested that it and *S. italica* form the tetraploid and diploid species respectively of one section of the genus *Setaria*.

47. RANGASWAMI AYYANGAR, G. N. and PANDURANGA RAO, V. 633.174:575:581.142
Vivipary in sorghum.
 Curr. Sci. 1935 : 3 : 617-19.

A note on the occurrence of vivipary in *Sorghum papyrascens* Stapf., M.S. 1401, a variety which is regarded as a mutant in regard to its primitive type of glume.

Seventy-five per cent of the grains in the viviparous ear had germinated.

The genetic factors thought to be responsible for the anomaly are being investigated.

48. RANGASWAMI AYYANGAR, G. N. and PANDURANGA RAO, V. 633.174:581.46:575.11
Stigmas and awns—their homology.
 Curr. Sci. 1935 : 3 : 540-42.

Marked correlations between awns and stigmas in awned forms of sorghum indicate that they are derived from the same basic tissue, but since awnless varieties have stigmas, this homology is only apparent when the factors inhibiting the expression of awn are absent. It is suggested that this is a case of genetic factors affecting the expression of homology.

49. RANGASWAMY AYYANGAR, G. N. and SANKARA AYYAR, M. A. 633.174-1.547.1-1.563
Germination tests on sorghum seeds preserved in earhead.
 Madras Agric. J. 1935 : 23 : 179-80.

A note for plant breeders who have to store seed. Viability is retained longer in grains from ears with their glumes than in loose seed. In irrigated varieties no germination was observed in seed kept for 7 years, 1-5 per cent only after 6 years, less than 50 per cent after 5 years and about 90 per cent kept for 3-4 years. Rain-fed sorghums deteriorated more rapidly.

50. RANGASWAMI AYYANGAR, G. N., SANKARA AYYAR, M. A., HARIHARAN, P. V. and RAJABHOOSHANAM, D. S. 633.174-1.557.519.241.1
The relation of some plant characters to yield in sorghum.
 Indian J. Agric. Sci. 1935 : 5 : 75-100.

The correlation between yield of grain per plant and the following characters was studied : thickness of head, length of head, diameter of peduncle, weight of dry straw, fresh weight of head, dry weight of head, weight of 100 grains and duration (number of days from sowing to commencement of anthesis).

High positive correlation values were obtained in the case of the first six. Weight of 100 grains gave high correlation values in "irrigated varieties" but correlation was low in "dry varieties." These characters are considered to be of value as indices of high yielding capacity. B. P. P.

RICE 633.18

51. SINGH, S. B. 633.18 Bangoa (54.5)
A new rice for the Kulu Valley.
 Seasonal Notes Punjab Agric. Dep. 1935 : 13 : 58-59.

In comparative trials with six other local varieties Bangoa gave the highest yield and is recommended for the Kulu Valley on irrigated lands up to an altitude of 5,000 feet.

The grain is white, moderately long and thin, does not break in hulling and has a good flavour. Bangoa is earlier by about a week than the local varieties tested.

52. HECTOR, G. P. 633.18:575(54.1)
Breeding and genetics of rice in India.
 Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 121-26.

After mentioning the importance of the crop in India and giving a brief outline of the botany of rice, the author defines the five agricultural groups to which the varieties of rice in Bengal belong. Within these groups the varieties are very numerous, and although no complete classification of the varieties of rice has yet been attempted (the number being probably greater than in any other crop), varieties can be classified within these groups on morphological and physiological bases.

A good deal of pure genetical research has been carried out in India, the characters most fully investigated being colour characters, of which there is a great range of variation in rice. Other characters worked on include glume length, grain shape, habit of plant, morphology of inflorescence and glutinous endosperm, all of which have been found to give Mendelian ratios, some simple, some complex.

As the Indian crop is largely grown for home consumption and only about 3 per cent is exported, the problem of improvement is largely one of increasing yield, resolving itself into the elimination of worthless varieties, and the improvement by selection and hybridization of the best varieties, suitable for distribution over the widest possible area.

53. MITRA, S. K. 633.18:575(54.1)
Rice breeding in Assam.
 Proc. World's Grain Exhibit. Conf. Canada 1933 : 2 : 131-34.

Systematic pure line selection has been carried on for several years at stations in Assam, over 2,200 types having been isolated as pure from about 650 samples. Varietal tests are carried out, using the "checker-board" system.

Hybridization is also carried on and details of the process are given. Two hybrids Karimganj 1 and 2 have already proved successful in cultivation and others are shewing promise.

Genetical studies have also been made on vegetative characters of the plant.

54. RAMIAH, K. 633.18:575(54.8)

Rice work in Madras—improvements effected.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 127-30.

The improvement of rice in Madras falls into two parts, viz. the selection of pure lines suitable for the different tracts of the Presidency (the method which has been the more productive so far) and hybridization. In connexion with the latter a technique of crossing, involving the artificial control of temperature and humidity around the panicle, ensures over 90 per cent success.

Genetical work is also being carried out on the Mendelian factors affecting many characters of the plant and grain, and linkage has been discovered in several cases.

A collection of pure lines of cultivated and wild types numbering over 600 has been amassed and data have been collected on them over a number of years, so that they provide a wealth of material for improvement.

In conclusion the economic value of the work is assessed, and a list of strains so far evolved is given.

55. WATSON, R. 633.18:575(59.2)

The improvement of Burma rice for the world's markets.

Proc. World's Grain Exhib. Conf. Canada 1933 : 2 : 134-38.

The main problem in rice breeding in Burma is the production of rice suitable for milling and export, i.e. having a good bold grain of uniform size, free from awns and red grain, giving the minimum amount of breakage when milled and, for the western markets, a pearly translucent type of grain that will also polish well. The two most important factors affecting breakage are the shape and hardness of the grain, and this problem is probably as important as "strength" in wheat.

The numerous local varieties, usually mixtures, result in excessive wastage at the mills, but from a diversity of types (over 2,000 pure lines) 10 pure strains have been selected, multiplied and distributed, and are replacing the local forms. The improved strains, including representatives of the five types of grain produced in Burma, are characterized by high yield, absence of red grains and awns, uniformity of grain and superior milling qualities.

Several hundred exotic varieties have been grown, but in the case of tropical varieties the pure selections of indigenous rice were superior in yield and quality, while sub-tropical forms were usually too precocious and though the quality was often maintained, yields were too small to be profitable. Hybrids between the latter and indigenous forms are being studied with a view to combining high quality and yield, and are also useful in that they give a useful and necessary variation in life period.

56. DASH, J. S. 633.18:575(88)

The rice industry of British Guiana.

Emp. J. Exp. Agric. 1935 : 3 : 237-47.

Inter alia mention is made of the necessity for breeding and distributing pure line seed to growers throughout the country and the establishment and method of work of pure-line control stations. Variety studies of imported rices and the breeding of new varieties are also in progress with the object of obtaining good strains ideally suited to local climatic conditions and cultural methods. Brief notes are given on some of the more important varieties.

57. RAMANUJAM, S. 633.18:575.242
633.18:581.162.51:576.354.46

Male sterility in rice.

Madras Agric. J. 1935 : 23 : p. 190

A mutant, arising in a pure line G.E.B. 24, was characterized by protracted growth, non-emergent panicles with spikelets that failed to open and contained much reduced and non-dehiscent anthers. Though the pollen was all aborted, the plant set a dozen seeds which gave normal

individuals and a good set of seed. The progenies of these 12 plants subsequently shewed a segregation of normal and sterile plants indicating that the original mutant type was a simple recessive. No intermediate types have been observed.

The reduction division appeared regular but degeneration of the spores set in after a fairly normal sporogenesis.

The mutant is stated to resemble another which arose in a different strain in which sterility of both pollen and ovule is due to asynapsis.

58. RAMIAH, K., PARTHASARATHY, N. and RAMANUJAM, S. 633.18:576.356.5
A tetraploid plant in wild rice (*Oryza longistaminata*).
 Proc. Ind. Acad. Sci. 1935 : 1 : 565-70.

Among vegetatively reproduced *Oryza longistaminata* a plant arose with thicker stems, darker internodes, broader, darker and thicker leaves, larger spikelets, and larger pollen grains with a considerable amount of abortion. Cytological investigation shewed it to be a tetraploid. Meiosis was irregular, with varying numbers of quadrivalents (7-11), univalents, lagging at anaphase I and II, and chromosomes lying outside the spindle. Well marked secondary association (in this case in twos, threes and fours), also found in other forms of *Oryza*, indicates that the basic number of this genus may be less than twelve. The plant probably arose by chromosome duplication in one of the buds.

59. RAMASWAMI, K. 633.18-1.557:581.48:575-181
The relation between the size of seed and the development of the plant resulting from it in rice.
 Madras Agric. J. 1935 : 23 : p. 240.

On raising plants from heavy and light seeds obtained from two pure lines Co.4 (with a six months' vegetative period) and Co.10 (with a four months' vegetative period) it appeared that the heavier seeds in both varieties germinated earlier and the resultant seedlings shewed greater vigour. Such differences however gradually disappeared in the case of Co.4 ; but in the case of Co.10 the greater vigour of the plants from the heavier seeds was maintained to the end.

If these results are confirmed, the elimination of light seed from varieties with a short vegetative period could be used as a method of increasing yields.

ROOTS AND TUBERS 633.4

60. SALAMAN, R. N. 633.491-1.524.2:575(47)
Russian research on the potato.
 Camb. Univ. Agric. Soc. Mag. 1935 : 22-25.

Since the cultivated varieties of potatoes existing today, with two exceptions, are derived from two original varieties brought to Europe in the sixteenth century, the opportunities for breeding new forms are limited, valuable genes, e.g. for blight resistance, having been lost owing to the process of selection which has gone on since then. New possibilities were opened up by the Russian expeditions to Mexico and South America in 1926, 1929 and 1930, to collect all the wild and cultivated forms of potato to be found.

Although the author does not agree with the conclusions at which the Russians have arrived about the origin of the potato, there is no doubt that the material they have brought back gives promise of valuable results, comprising polyploid species with $2n=24, 36, 48, 60$ and 72 , frost resistant, blight resistant and virus resistant forms, and a species which requires no dormant period.

Every effort is to be made by the Russian geneticists to produce forms suited to the varied conditions of Russia including testing within the Arctic Circle, grafting where sexual crossing is impracticable, and Asseyeva's method of growing resected tuber eyes.

61. COLLINS, E. J. 633.491-2.41-1.521.6:575.11
The problem of immunity to wart disease [*Synchytrium endobioticum* (Schilb.) Perc.] in the potato.
 Ann. Bot. 1935 : 49 : 479-91.

Breeding results, some taken from other papers by Cuthbertson, Salaman and Lesley, and Lunden and Jørstad (see "Plant Breeding Abstracts," Vol. II, Abst. 648, and Vol. V, Abst 569) and some the author's previously unpublished results from Ormskirk trials, are tabulated and discussed. It is suggested that the results, which are obtained from immune varieties selfed, immune x immune, susceptible selfed, susceptible x susceptible, immune x susceptible and susceptible x immune, indicate that the number of factors concerned is few rather than many. Factorial schemes for the genetic constitution of varieties are not put forward.

FIBRES 633.5

62. HARLAND, S. C. 633.51:575.11.061.633:575.127.2
The genetics of cotton. Part XIV. The inheritance of brown lint in New World cottons.
 J. Genet. 1935 : 31 : 27-37.

In the cross between the two *barbadense* varieties Enan's Brown Egyptian and pale cream Sea Island, inheritance of lint colour in the F_2 had previously been found to be of the blending type, though later generations shewed segregation into 3 brown : 1 white and it was considered that a single factor pair $K-k$ was involved, with several modifiers.

In the present work the range of colour was divided into 10 grades, from 1, pure white, to 10, full brown. The F_1 (grade 3-4) from Sea Island White T4 (grade 1) x Enan's Brown Egyptian T3 (grade 8) was back-crossed by Enan's Brown, the progeny segregating into light brown and dark brown difficult to classify. Eight of each class were selfed, whereupon the dark browns gave all dark brown progeny varying in grade among themselves, while the intermediate browns segregated into browns and lighter browns, the parental grade 1 being only rarely recovered. By repeated back-crossing and selfing monohybrid segregation was ultimately obtained, the recessive being grade 3 and the heterozygotes and homozygous dominants ranging from 6 to 8. Thus it is seen that there is a single pair of factors concerned, named K^b-k^b , and the plus modifiers accompanying the dominant in the brown forms are absent in the white. The recessive $k^b k^b$, accompanied by the plus modifiers gives light brown instead of white, while the heterozygote tends to be intermediate.

A negative correlation was found to exist between grade of colour and lint length both when the colour differences were determined by the factors K^b-k^b and when determined by the modifiers. It is considered therefore that selection for long lint has had the effect of eliminating from Sea Island White cotton the main K^b factor and then the modifiers which accompanied it.

On crossing Enan's Brown Egyptian by the *hirsutum* variety Upland Guatemala Khaki (grade 7) and back-crossing the F_1 to *hirsutum* white, a close approximation to a 3 : 1 ratio was obtained (if the class of minimum frequency was ignored). Hence it was concluded that brown lint in *hirsutum* was determined by a different, duplicate gene, termed K^h and this was supported by the results of the second back-cross.

The distribution of the known duplicate genes in *G. barbadense* and *G. hirsutum* is discussed in relation to the amphidiploid origin of New World cottons and it is suggested that the present species may have arisen from more than one original cross.

63. HARLAND, S. C. 633.51:575.113.3:575.127.2:576.16
The genetics of cotton. XII. Homologous genes for anthocyanin pigmentation in New and Old World cottons.
 J. Genet. 1935 : 30 : 465-76.

The factor R , a member of a multiple allelomorph series controlling anthocyanin pigmentation in Old World cottons ($n = 13$), produces in *G. arboreum* the character complex red plant body, red flower and intense flower spot. A hybrid between New World cotton, $n = 26$, and *G. arboreum* var. *sanguinea* (see "Plant Breeding Abstracts," Vol. II, Abst. 546) was back-crossed several times to *G. hirsutum* (a New World cotton) until the initial great sterility was modified into

complete fertility, and the factor *R* was thus transmitted to the New World species. In the *hirsutum* genotype the phenotypic effect of *R* was reduced, red coloration in the plant body and the flower being considerably less, and the flower spot completely lost. To explain this change in expression, it is postulated that in *G. arboreum*, *R* is accompanied by several plus modifiers, not present in *G. hirsutum*, or that the latter contains a neutralizing or diluting set of modifiers in the other 13-chromosome sub-genom.

To determine the relationship between the Old World cotton multiple allelomorph series of which *R* is a member, to the similar New World series, a heterozygous New World cotton (*Rr*) was crossed with Upland Red Spot (*SⁿSⁿ*). In the *F*₂ the inheritance of the two characters was almost purely alternative, shewing that *R* is another allelomorph of the New World series and hence that the New World and Old World multiple allelomorph series for anthocyanin pigmentation are homologous. This supports Skovsted's theory that the New World group is amphidiploid with one sub-genom homologous with the *n* = 13 Asiatic species *G. arboreum* and *G. herbaceum* (see "Plant Breeding Abstracts," Vol. IV, Abst. 864). From the present geographical distribution of the Asiatic and New World groups, it is suggested that the New World amphidiploids arose during late Cretaceous or early Tertiary times.

64. HARLAND, S. C. 633.51:575.113.5:575.127.2
633.51:575.242-181.13:575.115
The genetics of cotton. Part XIII. A third series of experiments
with the crinkled dwarf mutant *G. barbadense* L. The cross *barbadense*
crinkled x *hirsutum* crinkled.
J. Genet. 1935 : 31 : 21-26.

The present series of experiments, an extension of earlier work on the same mutant form (see "Plant Breeding Abstracts," Vol. II, Abst. 545, and Vol. IV, Abst. 558) were designed to get some idea of the diversity obtainable when the crinkled gene is placed upon the various rearrangements of modifiers in *hirsutum* x *barbadense*.

The *hirsutum* (T 9) crinkled was crossed with *barbadense* crinkled. The *F*₁ was strongly crinkled and the plants were quite uniform. In the large *F*₂ grown all types from an exaggerated crinkled (super-crinkled) to a type phenotypically indistinguishable from normal (pseudo-normal) were recovered.

A number of *F*₂ plants, representing all grades was selfed and by selection from uniform families in *F*₄ and *F*₅ and continued selfing, true breeding types were obtained ranging between the two extremes mentioned.

The results are consistent with the explanation previously given, viz. segregation in a number of modifiers. It is pointed out that should one of the modifiers occurring in a homozygous pseudo-normal mutate with observable effect, the allelomorphic relationship normal-crinkled could again result, and a duplicate gene would thus be produced.

65. SKOVSTED, A. 633.51:575.127.2
633.51:576.356.52
633.51:576.16
Some new interspecific hybrids in the genus *Gossypium* L.
J. Genet. 1935 : 30 : 447-63.

The groups investigated were : (1) with 26 small somatic chromosomes (a) *G. aridum* Skovsted, (b) *G. armourianum* Kearney, (c) *G. Davidsonii* Kellogg, (d) *G. trilobum* (Moc. et Sess. ex DC.) com. nov. ; (2) with 26 larger somatic chromosomes (e) *G. Sturtii* F. Muell., (f) *G. Stocksii* M. Mast., (g) *G. anomalum* Wawra and Peyr., (h) Asiatic cottons ; (3) with 52 somatic chromosomes, (i) New World cottons. The New World and Asiatic cottons were considered as two groups, and the hybrids between them were not studied in the present work. The 35 remaining combinations were all tried except one, and six have so far been unsuccessful. Results in the successful crosses include empty seeds, hybrids dying in the cotyledon stage, sterile hybrids and fertile hybrids. The results indicate that within the *n* = 13 species *G. anomalum*, *G. Stocksii* and Asiatic cottons form one group, *G. amourianum* and *G. aridum* another, with *G. trilobum* probably

intermediate. *G. Davidsonii* and *G. Sturtii* apparently represent two separate side groups. The species *G. trilobum* and *G. aridum*, often assigned to the genera *Thurberia* and *Erioxylum* respectively are considered on morphological and cytological as well as genetical grounds, to belong to *Gossypium*.

Hybrids between $n = 26$ (New World cottons) and $n = 13$ species are, as a rule, much easier to produce than hybrids between species with $n = 13$. The only hybrids sufficiently fertile to be of use to plant breeders were produced in the present work by crossing New World cottons with *G. aridum*, *G. armourianum*, and *G. trilobum*, and all have $2n = 39$.

A haploid *G. Davidsonii* was produced in attempting to cross with *G. trilobum*.

66. SKOVSTED, A. 633.51:575.127.2:576.312.34:576.356.7
Cytological studies in cotton. III. A hybrid between *Gossypium Davidsonii* Kell. and *G. Sturtii* F. Muell.
 J. Genet. 1935 : 30 : 397-405.

G. Davidsonii ($2n = 26$) has small chromosomes, both in somatic divisions and in meiosis, while *G. Sturtii* ($2n = 26$) has larger chromosomes in the two types of division. In the hybrid the distinction in chromosome size is retained, so that it is possible to observe directly the amount of auto- and allosyndesis at meiosis. Chromosome conjugation varies considerably from cell to cell and was studied statistically in 40 cells. The number of bivalents per cell ranged from 1-10, and about 10 per cent were autosyndetic. Only a few trivalents and one quadrivalent were observed. The chiasma frequencies of the two species were approximately equal (1.7+) while in allosyndetic bivalents in the hybrid there was a significant reduction.

The similarity in chiasma frequency suggests that the number of pairing blocks is substantially the same in the two species, while the retention of the difference in chromosome size in the hybrid leads to the inference that chromosome size is not in this case controlled by a genetic factor. It is suggested therefore that the difference is probably due to some unknown accessory substance.

The homology between the large and small chromosomes is in sharp contrast to the dissimilarity between the two sets in New World cottons. (Cf. "Plant Breeding Abstracts," Vol. IV, Abst. 864.)

67. 633.51-2.7-1.521.6:575(68)
The Cotton Experiment Station at Barberton.
 Fmg. S. Afr. 1935 : 10 : 279-81.

In this report a brief account is included of the development of the U.4 strain of cotton resistant to jassid. This strain which also gives a high yield has been the basis of all recent selection work which has given many new strains ; some of these are substantially better than U.4 Bulk and may be ready for distribution next year.

Crosses have recently been made between U.4 and Cambodia which is also extremely resistant to jassid and may increase the resistance of U.4.

68. AAMODT, O. S. and JOHNSTON, W. H. 633.52 Redwing
 633.52:575.42(71.23)
Redwing—a new seed flax for Alberta.
 Circ. Coll. Agric. Alberta 1935 : No. 19 : Pp. 17.

This flax originated from single plant and bulk selections from the strain Accession No. 91 obtained from the United States Department of Agriculture. In comparative trials it proved the earliest of the higher yielding small seeded varieties. It has a stiff straw of average length and gives a satisfactory weight per bushel, while yielding a good quantity of high quality oil. It is also resistant to wilt and partly so to rust.

SUGAR PLANTS 633.6

69. DUTT, N. L. 633.61:575(54.8)
Recent advances in sugarcane breeding in India.
 Proc. Ass. Econ. Biol. 1934 : 2 : Pp. 7.

Many Coimbatore varieties recently produced have been proved superior to earlier varieties and are to be distributed to areas for which they are suitable. Noble canes have also been bred and are being distributed for trial, while sugar cane x sorghum hybrids of different parentage are being tested at the various provincial experiment stations for earliness in maturity.

As an experiment, young sugar cane seedlings in pans are being sent from Coimbatore to certain of the provincial stations, so that from desirable crosses forms suited to provincial climatic conditions can be selected.

X-rays are to be used to induce mutations.

A frequent obstacle to crossing is disparity in flowering periods and efforts have been made to control it by planting at different times, smoking, "topping," photoperiodism, injection of $HgCl_2$, so far without much success. Vernalization might also be tried.

Studies on root growth and formations, morphological characters and flowering times have been carried out on *S. officinarum* and *S. spontaneum*.

Cytological studies have shewn that the Coimbatore form of *S. spontaneum* has 32 haploid chromosomes, while the amount of secondary pairing at meiosis in various forms of sugar cane (including *S. spontaneum*) suggests that the basic number of chromosomes in *Saccharum* is ten.

Characters to which attention has been directed of recent years in breeding work include disease resistance, habit (an erect habit of growth is desired) and "rind-hardness," instruments having been designed to measure resistance to piercing, while an instrument is being produced to measure resistance to crushing.

A soil survey with a view to determining the suitability of varieties is in progress, while the author suggests that an extensive varietal survey is needed and would yield important information about the types of variation found and the possible existence of valuable forms.

70. GLENDON HILL, A. 633.61:575(69.82)
Fifth Annual Report of the Sugarcane Research Station, Mauritius, for the year 1934. Part I. Cane breeding.
 Rep. Sug. Cane Res. Sta. Mauritius 1935 : 5-20.

Studies have been made on the relation between the results of first year seedling tests and of second year tests of the same clones. In the cases of weight per stool and number of canes per stool a considerable falling off was noticed, but only a slight falling off in percentage of total solids.

A list of 421 crosses made is given. Analysis of crosses during the past 5 years has shewn which crosses give most promise and can be concentrated on in future. Of the seedlings bred at the station at present under test, those of the fourth nobilized Glagah type shew most promise. Sterile sugarcane-sorghum hybrids have been produced at the station and also hybrids of sugarcane with *S. munja* (= *Erianthus sara*) ; the latter are not as promising for breeding material as first nobilized Glagah.

The local variety Uba Marot is considered not to be a sport of Uba, and hence the alternative name Gros Cailloux, it is suggested, would seem to be more appropriate.

Other points to which attention is being directed include tests for total solids throughout the ripening season to determine the early and late maturing clones, trials to determine the advisability of eliminating puny seedlings at the seed box or potting out stages of growth, and fuzz storage ; it has been shewn that seed can be stored in desiccators for 12 months in a viable condition.

The variety trials have been extended considerably ; newer varieties recommended are Selangor Seedling, S.W.499, P.O.J.2878 and P.O.J.2725. No seedlings bred by the station have as yet been released.

71. KERR, H. W. 633.61:575(94.3)
Sugar cane varieties and disease control. 633.61-2.3-1.521.6:575.42(94.3)
 Cane Growers' Quart. Bull. 1935 : 2 : 127-30.

A concise account of the history and development of the sugar cane from early times until the present day when disease resistance has assumed even greater importance than was formerly the case. The good and bad points of a number of varieties obtained by selection for desirable growth characteristics and resistance to gumming disease are briefly stated ; and it is believed that the elimination of the older susceptible varieties in cultivation should soon be possible. Some promising new canes are under observation.

72. MANGELSDORF, A. J. 633.61:575:576.312
Recent developments in sugar-cane breeding.
 Proc. 5th Pacif. Sci. Congr. Canada 1934 : 4 : 2631-35.

Sugar-cane breeding may be considered to have begun with the discovery in 1886 that the minute seeds of sugarcane are capable of germination. Chromosome numbers in the various forms have been reported as follows : *S. officinarum* $n = 40$, *S. sinense* and *S. barberi* (Indian varieties) $2n = 82, 90, 91, 92, 107, 116$ and 124 in different forms, *S. spontaneum* (wild species) $n = 56$ usually, $n = 40$ in two forms, *S. robustum* (from New Guinea) $n = 20$ (probably).

The advent of steam power mills and plantation type of agriculture led to a need for more disease-resistant varieties, which has been met by the introduction of wild "blood," as in the case of P.O.J.2878, which is resistant to the disease "sereh" and is a good sugar producer.

Variations in flowering habit, including male-sterility, self-sterility and occasionally failure to tassel affect the technique of breeding. Cross-fertilization being the rule in sugarcane, selfing results in weakly plants, while progress in a programme of selfing followed by crossing of inbred strains has been slow owing to the frequency of various forms of sterility.

The smallness of the flowers makes emasculation impossible, but self-sterile or male sterile varieties can safely be used as female parents by being surrounded by several tassels of the other parent. This can be done most efficiently by placing the cut tassels of both parents with six to eight feet of stalk in a pail of .03 per cent sulphur dioxide solution with .01 per cent phosphoric acid added. In this solution the tassels live for three to five weeks, long enough to ripen seed.

Hybrids between species with different chromosome numbers often result in sterile hybrids, but in the case of *S. officinarum* ($n = 40$) \times *S. spontaneum* ($n = 56$) complete fertility is found in the hybrid, which has 136 somatic chromosomes and a high degree of pairing at meiosis. Bremer considers that the 40 *officinarum* chromosomes have doubled in the ovules, as a result of pollination with *spontaneum* pollen, and that they pair among themselves in the hybrid, while the *spontaneum* chromosomes form 28 bivalents among themselves.

73. KHANNA, K. L. 633.61:581.44:578.08
An improved instrument for testing rindhardness in sugarcanes.
 Agric. Live-Stk. India 1935 : 5 : 156-58.

A description of an instrument used for measuring the hardness of the rind in growing sugar canes. The needle which pierces the rind is attached to a piston which compresses a measured capacity spring encased in a barrel, and a pointer attached to the piston indicates the force used in pounds weight.

STIMULANTS 633.7

74. 633.71 Harrow Velvet
 633.71.0014(71)
 MACRAE, N. A. and HASLAM, R. J. 633.71-2.42-1.521.6:575(71)
Varietal studies of flue-cured, Burley and dark tobaccos.
 Bull. Dep. Agric. Can. 1935 : (N.S.) No 178 : Pp. 61.

A brief historical sketch of the work on varietal studies and classifications of *Nicotiana* is followed by a discussion on the present taxonomic status of certain forms and varieties. Descriptions are then given of a large number of varieties classified into nine groups and particulars are recorded of field growth measurements, descriptions of growing plant and green leaf, i.e. relative maturity, yields, quality and methods of sorting and grading. The general classification was based almost

entirely on field growth characteristics while certain selected varieties were classified according to combined characteristics with special reference to commercial adaptability.

The appendix contains an account of the origin and development of a promising new Burley variety, "Harrow Velvet," its degree of resistance to root-rot and other characteristics.

75. SALMON, E. S. 633.79 Cats'-tails (42.23)
633.79:575.127.2

"Cats'-tails": a new variety of hop.

J. S.-E. Agric. Coll. Wye 1935: No. 36: 41-47.

A new seedling variety derived from natural crossing of *Humulus americanus* var. *neo-mexicanus* and an English male hop *H. lupulus*. Its botanical and general characters are described. Though its aroma is strong or "rank," of the American type, the new variety has its use as a powerful copper hop and is a heavy yielder with very large cones.

OIL PLANTS 633.85

76. JACK, H. W. 633.855.34-1.577:575.22:575.42
Variation in oil palms with special reference to fruiting characters.
Proc. 5th Pacif. Sci. Congr. Canada 1934: 4: 3311-15.

Great variation in yield of fruit of pericarp and of kernel indicates that selection could bring about considerable improvement.

FRUIT TREES 634

77. GRUBB, N. H. 634.711:575(42.23)
634.711:575.11
Raspberry breeding at East Malling 1922-34.
J. Pomol. 1935: 13: 108-34.

The characters of a good commercial raspberry are described; no commercial variety at present grown approaches the standard set, but most of the characters can be found in different varieties. The three main methods of breeding tried at East Malling are selfing and crossing commercial varieties and crossing selfed seedlings. By selfing varieties improved forms are not likely to be obtained except when the parent varieties are not very desirable, unless very large families be raised. In the crosses much better success is to be expected from crosses between selected selfed seedlings than from crosses between varieties. The value of the families raised from different varieties by these methods is indicated and it is pointed out that the value of a variety is no index of the value of the selfed seedlings raised from it, nor do those varieties which, when selfed, give the largest proportion of promising seedlings always give equally promising results on crossing.

In one family a definite though incomplete correlation was found between red spines and dark fruit on the one hand and tinged spines and fruit not turning dark on the other.

Increasing attention is being devoted to the question of mosaic infection.

In the course of the breeding work several points of genetical interest have emerged which are discussed in relation to the results of Crane and Lawrence (see "Plant Breeding Abstracts," Vol. I, Abst. 19.) The latter's conclusions on the inheritance of colour are in the main supported, though the connexion between spine and fruit colour is not absolute and the presence of other linked factors is suggested.

The constitution of certain varieties with respect to the factors *P* and *T* is given. Two genetical types of chlorophyll deficiency are described. In connexion with the inheritance of sex only the occurrence of female-sterile (male and neuter) forms was noted. These occurred in the selfed progeny of eight out of nineteen varieties and it is suggested that before the Lloyd George variety became so common, such sterile "rogues" were common in commercial plantations. Four hairy forms tested proved to be heterozygous for hairiness, supporting the suggestion of Crane and Lawrence that the homozygous form is suppressed by a lethal factor. A complete absence of spines, apparently due to a simple recessive factor, appeared in selfed progeny of Burnett Holm. Other plants of interest mentioned include some from Red Cross selfed, with corymbose inflorescences, three from Burnett Holm selfed, with sepaloid petals and in some flowers petaloid stamens, and one plant from Norwich Wonder A selfed which appeared to be identical in all respects with the variety Red Antwerp B.

78. AGHARKAR, S. P. and BHADURI, P. N. 634.771:576.312.35
Variation of chromosome numbers in *Musaceae*.
 Curr. Sci. 1935 : 3 : 615-17.

According to chromosome counts of species and varieties of the genera *Musa* and *Heliconia* the diploid number in the variety *Aithya* proved to be 22, in the variety *Amritasagar* 33, in a species provisionally identified as *Musa rubra* Wall. 22 (though 23 was also found) and in *Musa superba* Roxb. 18.

The discrepancies or agreement between these results and those of Larter and Cheesman and other workers are pointed out.

Instances of constant variation in the diploid chromosome number in different cells of the same tissue were also found in some of the varieties of *Musa* and in *Heliconia*.

Bi-nucleate cells were also observed, without, however, the double number of chromosomes. Variation in the chromosome size was also marked in both genera. There was also a pronounced tendency to grouping of chromosomes in chains in some of the edible bananas, whereas this phenomenon was absent in the seeded species *Musa superba*.

79. 634.836.72:575(94.5)
 634.843.091(94.5)
 634.851.09(94.5)
 CASTELLA, F. de
Phylloxera-resistant vine stocks including some recent introductions.
 J. Dep. Agric. Vict. 1935 : 33 : 281-88.

The present and future importance of the problem of resistant stocks in Australia is outlined. The history of *Vitis riparia* and *V. rupestris* is followed by brief accounts of the hybrid stocks of America and France, including *V. Berlandieri* and its various well known hybrids with *V. riparia*.

FORESTRY 634.9

80. DAVY, J. B. 634.973:577.811
Male trees of *Salix alba* var. *caerulea*.
 Forestry 1935 : 9 : 58-59.

Examples from the experience of author and others are quoted of staminate trees indistinguishable from *S. alba* var. *caerulea* in vegetative characters, though growers and buyers generally are of the opinion that only females of the Cricket-bat Willow exist.

81. CHAMPION, H. G. 634.975:575:581.446.1
Second interim report on the progress of investigations into the origin of twisted fibre in *Pinus longifolia*, Roxb.
 Indian For. 1930 : 56 : 511-20.

A report on the results obtained when the trees were 13 to 14 seasons old and measurements could be taken at breast height. Seed was grown at four locations, the classes of seed grown being : (1) imported seed from straight trees in straight locality (i.e. locality where all trees have straight fibres), (2) local seed from straight trees in straight locality, (3) seeds from straight trees in twisted locality, (4) seed from twisted trees in straight locality, (5) seed from twisted trees in twisted locality and (6) natural regeneration in twisted locality. The average degree of twist of the fibres was measured and also the percentage of the trees having a degree of twist (7° or over) seriously limiting the use of timber sawn from them.

The figures show that production of twisted fibre is an inherited character and is not influenced by soil, underlying rock, and aspect. It is suggested that it is of the nature of a dominant Mendelian character. By use of imported seed from a suitable source a crop may be obtained free of twist, at least up to the seedling stage, even in localities where the original crop is 100 per cent twisted. In discussing the practical applications of the results the author stresses the importance of using seed from straight trees in regeneration, and of the early felling of unfit trees.

Attempts to produce twisted fibres by wire binding and partial girdling failed except for a purely local effect in the latter case.

A secondary effect of twisted fibre is to cause spiral contortion of the stems as a result of snow pressure.

VEGETABLES 635

82.

635.64 Red Marhio
635.64 Pink Marhio
635.64:575

Are there two strains of Marhio tomato?

Agric. Gaz. N.S.W. 1935 : 46 : p. 325.

The possibility of the existence of two strains of this tomato is being investigated. In the meantime the two very different lots of plants obtained from seed imported at two separate times are temporarily being given the names of Red Marhio and Pink Marhio.

83.

UPCOTT, M.

635.64:576.365.5:576.354.46

The cytology of triploid and tetraploid *Lycopersicum esculentum*.

J. Genet. 1935 : 31 : 1-19.

The types of chromosome associations at meiosis were studied in the diploid, triploid (diakinesis and metaphase, considered as one) and tetraploid (diakinesis only). The multivalents in the triploid and quadrivalent occurred in the types and frequencies to be expected in an organism with completely terminalized chiasmata on the assumption that chiasma formation is at random. The number of half-chiasmata per chromosome was 1.66, 1.19 and 1.56 in the diploid, triploid and tetraploid respectively, the difference between the diploid and triploid being attributed to a difference in the number of chiasmata originally formed rather than to differences in terminalization.

It is stated that the configurations are statistically constant from diplotene to metaphase.

The variance in the number of half-chiasmata per chromosome is greatest in the triploid and least in the diploid, which is accounted for by the fact that in the triploid variance is due to two kinds of variations, viz. the length of chromosomes paired and the chiasma frequency per length paired.

Irregularities followed multivalent formation and in the triploid, restitution nuclei were found when a large number of univalents had occurred. Non-disjunction in the tetraploid occurred as a result of the formation of quadrivalents and it is shewn that this is adequate to explain the reduction in fertility of the tetraploid.

84.

635.657:581.162.3

RAMANATHA AYYAR, V. and BALASUBRAHMANYAN, R.

Anthesis and pollination in Bengal gram (*Cicer arietinum*).

Madras Agric. J. 1935 : 23 : 170-78.

From 1931 to 1932 observations were made at Coimbatore on anthesis, dehiscence of the anthers and pollination in *C. arietinum*, a plant which opens and closes its flowers on two successive days. The data shewed that the flowers were protandrous and that pollination is completed in the bud stage. The few aberrant plants observed proved to be mutants, not hybrids, and self-pollination seems to be the invariable rule.

Cleistogamy was observed; it was apparently more marked in the summer crop and its rate of incidence may be due to nutritional factors.

The successful technique of hybridization described, differs from that of Khan and Aktar (Cf "Plant Breeding Abstracts," Vol. V, Abst. 40) in that the petals are not removed and muslin bags are not required.

Differences between these findings and those recorded at Pusa are pointed out.

85.

635.659:576.312.35

KRISHNASWAMI, N. and RANGASWAMI AYYANGAR, G. N.

Chromosome numbers in *Cajanus indicus*, Spreng.

Curr. Sci. 1935 : 3 : 614-15.

Twenty-five pollen mother cells from flower buds from three varieties of *Cajanus indicus* Spreng. were cytologically examined at various stages and shewed the haploid chromosome number to be eleven. The chromosome behaviour is described.

Part II. Foreign

STATISTICS 519

86. DEREWITZKY, N. 519.24:631.421
 Bearbeitung der Ergebnisse von Versuchen mit ausfallenden Parzellendaten.
 (Treatment of the results of experiments with missing plot data.)
 Arch. PflBau. 1934 : 10 : 573-85.

The data of field experiments in which for one reason or another certain plot values are missing are considered, and the mathematical solution is furnished of the problem of determining the best values for the missing plots from the rest of the data. J. W.

87. LIVERMORE, J. R. 519.24:633.491-1.421
 The potato field trial.
 Amer. Potato J. 1935 : 12 : 142-50.

Some views on statistical interpretation.

88. MILES, S. R. 519.241
 A very rapid and easy method of testing the reliability of an average
 and a discussion of the normal and binomial methods.
 J. Amer. Soc. Agron. 1935 : 27 : 21-31.

Two commonly used methods of testing significance are described. The *normal method* is based on the distribution of individual values in an infinite population, while the *binomial method* is based on the distributions of "successes" and "failures" when a "success" and a "failure" are equally likely. The methods are explained and compared, and the use of tables for calculating odds by either method is outlined. A short method of performing the calculations is described, this having two phases corresponding to the two methods employed. J. W.

89. WIEBE, G. A. 519.241:633.11-1.557-1.421
 Variation and correlation in grain yield among 1,500 wheat nursery plots.
 J. Agric. Res. 1935 : 50 : 331-57.

The data are presented of a uniformity trial in which the yields of 1,500 contiguous wheat plots each one row wide and 15 feet long, the rows being 12 inches apart, were determined. Calculations are performed to bring out the nature of the variability present over the acre, and the degree of correlation between rows at different distances apart. The chief conclusions are as follows:—Variation tends to decrease with the increase in plot size, total area remaining constant. Correlation between rows decreases steadily as the distance between them increases. Combination of non-contiguous unit plots to form large aggregates was considered. Their variation was found to approach the total variation, but to decrease with increase in the size of the aggregate. Complete random distributions gave less bias to the estimate of experimental error than systematic distributions. A smaller experimental error was obtained by grouping the varieties of each replication so as to make the distance separating them a minimum. The application of this "principle of maximum contiguity" is suggested in nursery practice. J. W.

GENETICS 575

90. SHULL, G. H. 575.1:00.14
 The word "allele."
 Science 1935 : 82 : 37-38.

A note urging the universal adoption of the word "allele" for "allelomorph" in genetic terminology.

575.125

91. KANIEWSKI, K. 633.11:575.125:581.46
 Die gesteigerte Wüchsigkeit der Bastarde im Lichte des Mendelismus. (**The increased vigour of growth of hybrids considered in the light of Mendelism.**)
 Warsaw 1935 : Pp. 24.

In a critical review of relevant points in the literature on hybrid vigour and inbreeding regarded mainly as a Mendelian phenomenon the views of Jones and Malinowski are subjected to full analysis by the author, whose own theory of heterosis arose out of the following experiment. From a cross between the dense eared *Triticum polonicoides* (with short internodes) and the lax eared *T. durum* (with long internodes) the expected F_2 ratio was obtained, namely 1 *polonicoides* (*PP*) : 2 intermediate (*Pp*) and 1 *durum* type (*pp*). But it was also noticed that over 100 plants of the *polonicoides* type had less dense ears than the laxest *T. durum* ear, which did not occur in the F_2 plants of the *durum* type. Moreover, in the F_2 it was plants of the *durum* type that had the densest ears; and finally the difference between the internode length in F_2 was greater in the laxest forms of the types *PP* and *pp* than in the densest forms of the same types.

In explanation of these observations it is suggested that the effect of the factors for laxness of ear are intensified in the presence of *Pp* as compared with their effect when *pp* is present. On the basis of the foregoing experiment heterosis is interpreted as due to some cause (whose nature and source is unknown) which intensifies the action of the genetic size factors. Hypothetical examples are constructed to explain this conception, which is claimed to be capable of elucidating certain instances of heterosis that are apparent exceptions on the basis of any of the other well-known interpretations. (Cf. "Plant Breeding Abstracts," Vol. III, Abst. 378, Vol. V, Abst. 310, 975.)

92. TSCHERMAK-SEYSENEGG, E. 575.127:581.163
 Über hybridogene Pseudoparthenogenesis. (**Hybridogenous pseudo-parthenogenesis.**)
 Züchter 1935 : 7 : 137-43.

"Hybridogenous" parthenogenesis is discussed by the author and is taken as meaning the cases in which the foreign pollen reaches the egg cell but the whole male nucleus disintegrates without fusion; development of the egg cell follows, so giving the appearance of parthenogenesis. A doubling of the chromosome number may occur so that the resultant plant has all the characteristics of the product of selfing. Experiments were therefore devised in which a plant with recessive seed characters was used as the female and one with dominant characters as the male parent and all possibility of self-pollination was carefully excluded.

The crosses, which with their results are given in tabular form were of *Pisum (arvense and sativum)* x *Vicia sativa* and the reciprocal, *P. arvense* x *V. Ervilia*, Lentil x pea and the reciprocal, *V. sativa* x lentil and the reciprocal, lentil x *V. Ervilia* and the reciprocal and *V. Ervilia* x *V. sativa*.

In many cases pods developed without seeds but here and there a seed occurred. The progeny have already been tested in the F_2 and are identical with the female parent. In the few cases in which the root tips were cytologically investigated the cells had the diploid and not the haploid number of chromosomes. How the doubling occurs has yet to be determined.

93. SAX, K. 575.127.2:576.312:576.354.4:633
The cytological analysis of species hybrids.
 Bot. Rev. Lancaster Pa. 1935 : 1 : 100-17.

In general, chromosome pairing and chiasma formation are dependent on chromosome homology, but in some cases they may be affected by genetic and environmental factors, so that caution must be used in interpreting results; the discovery of association of non-homologous chromosomes in maize is another complication.

Hybrids between species with the same chromosome number are sometimes completely fertile with complete pairing at meiosis, indicating that the parent species differ only in genes or at most in small structural changes. Chiasma frequency may be reduced somewhat in the hybrid,

or it may be genetically controlled. Such close affinity has occasionally been found in generic hybrids (e.g. *Zea-Euchlaena*). More usually a certain amount of sterility, sometimes complete, is found in species hybrids, usually associated with irregularities at meiosis, due to lack of homology or structural changes. Of special interest in the latter case is reciprocal translocation, leading to ring formation in the hybrid. Occasionally sterile hybrids are found to have regular pairing at meiosis, in which case the sterility may possibly be attributed to deficiencies or unbalance in the gametes resulting from structural differences in the pairing chromosomes.

Hybrids between species with different chromosome numbers are almost always sterile to some degree. The simplest form of autopolyploid hybrid is the triploid. In this trivalent formation depends on chiasma frequency and the type of distribution leads to gametes with chromosome numbers following the normal frequency curve. Occasionally autotetraploidy occurs. Allopolyploid hybrids form varying numbers of bivalents and univalents at meiosis, the behaviour of the univalents varying from species to species. The most interesting aspect of allopolyploid hybrids is that of amphidiploidy with its bearing on evolution. As a general rule, the fertility of an amphidiploid is in reverse proportion to the fertility of the original hybrid.

Study of chromosome behaviour in hybrids gives an index of relationship between species, provided the exceptions mentioned are borne in mind.

94. KASPARYAN, A. S. 575.129:576.356.5(016)
 (Survey of works on polyploidy and amphidiploidy during recent years.)
 Bull. Appl. Bot. Leningrad 1934 : Ser.2(6) : 205-22.

A review is given of the numerous examples of amphidiploid hybrids now known and of the most favourable methods of inducing chromosome duplication. Various cases where the polyploid is larger than the corresponding diploid are quoted. Amphidiploids whose chromosome behaviour is the same as in autopolyploids are mentioned, as well as those shewing regular pairing as in diploids and various degrees intermediate between these, shewing that the line between amphidiploids and true polyploids is now becoming very difficult to draw. The tendency to form multivalents is shewn to be dependent more on the number of chiasmata normally formed by the chromosomes of the initial species than on the degree of homology of the different sets in the polyploid.

The different types of multivalent association observed in polyploids are described, followed by a discussion of the varying degrees of fertility associated with different amounts of multiple association, the varying degrees of sterility existing between the polyploid and initial and allied forms, and of the genetics of polyploid forms, and finally numerous instances of amphidiploid species occurring in nature are enumerated.

95. DEMEREC, M. 575.17:575.113.3
 Unstable genes.
 Bot. Rev. 1935 : 1 : 233-48.

A review of the results of studies on the nature of the gene changes as seen in visible effects upon *Drosophila* and economic and other plants with special reference to work on unstable genes.

Genic instability is usually manifested in one direction only, i.e. from a recessive into a dominant allelomorph. One instance of a reversible change has been recorded affecting the pericarp colour in maize. A further type of change has been observed in various organisms including maize, namely, changes from one unstable allelomorph into another.

The effects of age, sex, and other internal factors such as modifying genes and the stage of ontogeny of the organism upon the rate of change of unstable genes have also been investigated; the influence of external factors still remains for the most part unexplored with the exception of temperature effects.

Instances are cited to shew the enormous variety of characteristics affected by unstable genes, colour variegations being the most frequently observed since they are easily detected.

Various hypotheses put forward from time to time to explain the facts interpreted as due to genic instability are considered and a possible relation between the gene and the evolution of the chromosome is briefly mentioned.

There is a bibliography of 64 references.

96. CARTLEDGE, J. L. and BLAKESLEE, A. F. 575.24:581.01
Mutation rate from old *Datura* seeds.
 Science 1935 : 81 : 492-93.

The seeds in question, buried for 22 years in soil under more or less natural conditions, had been unaffected by whatever influences may produce mutations ; and age alone does not greatly, if at all, increase the mutation rate.

97. MORITZ, O. 575.25
 Das Chimärenproblem und angrenzende Fragen in ihrer Bedeutung für die Genetik. (**The chimaera problem and related questions in their importance for genetics**).
 Züchter 1935 : 7 : 143-55.

The discussion of the genetical importance of chimaeras and related problems follows closely the work of Krenke "On compensatory reactions to wounding and on grafting and chimaeras in plants" (see "Plant Breeding Abstracts" Vol. IV, p. 253).

Chimaeras and especially the so-called burdos are of special interest to plant breeders, since if it were possible to produce such hybrids regularly, new gene and plasma combinations could be undertaken. The results of investigation on the effect of the stock on the scion are discussed including the author's work on the existence of antibodies and antigens.

The secondary phenomena induced by wounding during grafting and other operations also offer many new possibilities and problems to the plant breeder.

EVOLUTION 576.12

98. SHULL, A. F. 576.12:519.2:575.1
Weismann and Haeckel : one hundred years.
 Science 1935 : 81 : 443-52.

A survey of the position of evolutionary theory to-day, on the occasion of the hundredth anniversary of the birth of Weismann and Haeckel. The development of genetics has provided a sounder foundation for such theories, and the mathematical study of evolutionary processes, provided it is based on sound biology, leads to progress along hitherto unknown paths. The author insists that mutations are limited in direction by the nature of the genes, that all characters are not necessarily adaptive, and hence considers that the power of selection as an evolutionary force has been over-estimated by some workers (notably Fisher) and refers to the value of a theory of orthogenesis.

Turning from the statistical side of the question to the question of isolation, he suggests that where geographic barriers do not exist, isolation of a group is brought about by the occurrence of sterility in hybrids, which may possibly be due to specific genes.

99. BLUM, H. F. 576.12:575.2
A consideration of evolution from a thermodynamic viewpoint.
 Amer. Nat. 1935 : 69 : 354-69.

The author considers that the idea of evolution by mutations random in direction followed by natural selection is unsatisfactory, all evolutionary processes being then reversible ; some directive influence, some degree of irreversibility is required, and to supply this need he invokes the second law of thermodynamics.

By examining the processes of evolution of the environment, (i.e. of the earth) he shows that the increase in entropy required by this law has, by reducing the reversibility of the chemical reactions occurring, ensured that a given evolutionary path, once taken, will be followed by the evolving system.

These principles he applies to the evolution of living systems and so deduces that degree of irreversibility in evolutionary changes which, he suggests, provides the directive force in organic evolution.

100. DARLINGTON, C. D. 576.354.4
Chromosome mechanics. 576.353

Bull. Appl. Bot. Leningrad 1934 : Ser. 2(6) : 237-43.

A very brief outline of the author's theory of mitosis and meiosis.

101. VOROBIEV, A. I. 576.356.5(016)
(Multiple chromosome numbers in related forms).
 Bull. Appl. Bot. Leningrad 1934 : Ser. 2(6) : 37-101.

A comprehensive dissertation on the literature on polyploidy and polyploid series, beginning with the earliest observations on polyploidy by Lutz in 1907. The discussions on the nature of polyploidy and the different kinds of polyploids are reviewed, and then the methods of producing polyploids and the various processes which lead to chromosome duplication, Winge's principle of the origin of polyploidy and of new species by chromosome duplication after hybridization, and the cytological behaviour in polyploids of different types ; the meiotic behaviour of the different types of interspecific hybrids is described, leading to a consideration of the different irregularities that may lead to chromosome duplication. The work on chromosome morphology leading to the identification of chromosome sets is also reviewed, followed by a discussion of the effect of polyploidy on the phenotype and the inheritance of the characters in the various types of polyploid. The numerous difficulties of establishing the chromosomal relationships in polyploid species and of relating the phenomena of polyploidy directly with the supposedly polyploid species are discussed ; these latter are mainly of hybrid origin and the phenomena associated with " true " or autopolyploids are not applicable to them ; the various suggestions for overcoming the confusion between the two types of polyploid are considered. The truer nature of any given plant, particularly the question of whether it is a true autopolyploid or an allopolyploid of hybrid origin, can be decided only by combining a genetical study with the cytological examination ; especially in view of the growing doubt as to the validity of chromosome conjugation as a criterion of homology. The role of chromosome multiplication in the origin of species and its importance from a practical viewpoint are finally discussed. A full bibliography terminates the paper.

102. BEATUS, R. 576.356.5:575.114:576.354.46
 Genetik und Chiasmotypie bei Polyploiden. (**Genetics and chiasmotypy in polyploids**).
 Biologie 1935 : 4 : 1-11.

After defining polyploidy, the author describes briefly the theory of factor pairing and segregation in auto- and allopolyploids.

The classical theory of chiasmata and Janssen's, Darlington's and Belling's theories of crossing-over are outlined, and the arguments derived from chiasma formation in autopolyploids in favour of partial chiasmotypy are recapitulated.

103. BRESLAVETZ, L. P. 577.8(016)
(Determination and heredity of sex in higher plants).
 Bull. Appl. Bot. Leningrad 1934 : Ser. 2(6) : 103-41.

The existing knowledge on sex determination is comprehensively reviewed. The recognition of the existence of sex in plants is shewn to date back to early Egyptian times, and its gradual acceptance in modern times is briefly traced. The " morphological " theory of sex determination, embodied in the principle of sex chromosomes, is reviewed, the different cases being taken in turn. The types of sex chromosomes and the way they differ from the autosomes are described and the names of the plants in which sex chromosomes have been observed are tabulated. It is pointed out that although not by any means all the dioecious plants are included in this list, yet

it must be taken into account that in most cases only the male and not the female forms have been investigated. A study of the females, though more difficult, might provide further evidence. The views of the supporters of the physiological theory of sex determination are next analysed. The truth is seen to be in the interaction of these two types of influence, represented by the genes for sex on the one hand, and their reaction to the organism and the environmental conditions on the other.

Sex ratios are next dealt with, and finally artificial sex control, the factorial inheritance of sex and sex linkage. The review ends with an extensive bibliography.

BOTANY 58

104. 58
575.1
575.24
BLAKESLEE, A. F.
Hugo de Vries. 1848-1935.
Science 1935 : 81 : 581-82.
Obituary notice.

105. 58:633:575.1
WOODS, A. F.
Botany and human affairs.
Science 1935 : 81 : 573-78.

This discussion alludes to the economic importance of the development of the science of genetics and its subsequent practical applications, the changes induced by the action of light in flowering and fruiting and the study of the environmental, nutritional and genetic factors controlling the production of valuable organic constituents in plants.

106. 581.143.26.03
CÂMARA, A. DE SOUSA DA
Subsídios para o estudo da vernalização. (**Further points on the study of vernalization.**)
Rev. Agron. Lisboa 1934 : 22 : 15-20.

The importance of early maturity in regions of irregular rainfall is emphasized, followed by an account of the method and the great possibilities of vernalization ; the author points out the necessity for strictly defined conditions for each plant and remarks that the many cases of failure can therefore in no way be taken as disproving the theory. Further emphasis is laid on the principle that the requisite conditions are constituted by a complex of factors, all of which must be suitably adjusted to produce the desired effect.

Experiments were performed at the Instituto Superior de Agronomia, Lisbon, in 1933/34 with *Triticum durum*, *Trifolium alexandrinum* and *Vicia Faba*, which were treated by the method described by Lyssenko for 55 days at a temperature of 1-5°C.

The treated seeds germinated more rapidly than the untreated in all three plants and their early development was more rapid ; in the later stages however no difference at all was evident. In the beans the attack by *Orobanche* was somewhat delayed in the treated as compared with the control plants.

No yield differences were observed in favour of the treated wheat, and in fact the treated plants yielded slightly, though not significantly, less than the control in the unmanured plots. Judgment as to the efficacy of vernalization is reserved until further results are available.

107. 581.143.26.03
PIRES, D. R. V.
Impressões sobre vernalização. (**Impressions of vernalization.**)
Rev. Agron. Lisboa 1934 : 22 : 21-26.

Calling attention to the great possibilities of the method of vernalization if proved practicable in Portugal, the author refers to experiments carried out in Sweden by Åkerman, in which he assisted in 1934. Two wheat varieties, Extra Kolben II and Diamant, were treated by Lyssenko's method. A slight acceleration in germination was observed in both varieties, especially the former, but in the later stages no difference at all was detected between treated and controls.

The experiment was repeated with two varieties of winter wheat, Standard and Sammet, treated for 20 and 30 days. The spring wheats Extra Kolben II, Diamant, Svalöfs Kolben, Aurore, Hallands, Dala, Strubes Schlanstedter and Peragis were treated for 14 days, the barleys Gull and Vera for 20 and 10 days, the oats Seger and Orion II for 20 and 10 days and the peas Torsdag and Concordia for 30, 20 and 10 days. Again the germination was accelerated, this effect being very pronounced in Sammet Wheat and much less so in Standard; no difference in effect was observed between the two periods of treatment. Some of the spring varieties germinated more vigorously after treatment, e.g. Diamant, others less vigorously, e.g. Aurore. Similarly in the barleys, Gull was very markedly accelerated and Vera much less so, the 10 day treatment having in the latter case more effect than the 20 day. In oats Orion II shewed an acceleration in germination, and in peas only the variety Concordia with the 10 day treatment shewed any acceleration.

In the later stages of growth again no difference was observed between the treated and control plants and the author refers to experiments of a similarly negative character seen by him in Finland and at the Kaiser Wilhelm Institut für Züchtungsforschung in Germany. In view of the success reported in the U.S.S.R. and the U.S.A. it is thought that the treatments applied may have been inadequate.

FIELD TESTS 631.421

108. MACK, W. B.

631.421:519.24

Methods in variety trials.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 491-92.

Yielding capacity is one of the most difficult characteristics to measure, and large differences are often required, sometimes as much as 40 per cent, before they can be considered significant. Type analyses however, when based on quantitative measurements, give results subject to rather small errors and afford a more practical method of comparing strains.

PLANT DISEASES 632

109. RUDLOFF, C. F.

632.42:576.16:634.11

Venturia inaequalis (Cooke) Aderhold. III. Zur Formenmannigfaltigkeit des Pilzes. [*V. inaequalis* (Cooke) Aderhold. III. On the polymorphism of the fungus.]

Gartenbauwiss. 1934 : 9 : 105-19.

Monosporidial cultures of *V. inaequalis* obtained from numerous varieties of apples when carried on upon a series of similar substrates under identical conditions, exhibited astonishing polymorphism.

Owing to the hitherto insurmountable difficulties in the way of a genetic analysis of *Venturia*, a morphological and physiological analysis was undertaken of two collections, "Zuccalmaglio" Rtte. and "Boskoop," each obtained from a different source, in order to demonstrate if possible the existence of distinctive racial characteristics. It was found that Zuccalmaglio and Boskoop each gave a specific reaction on all the media tested except one.

110. RĂDULESCU, E.

632.451.2:576.16:633.11

Untersuchungen über die physiologische Spezialisierung bei Flugbrand des Weizens *Ustilago tritici* (Pers.) Jens. [*Investigations on physiological specialization in wheat smut U. tritici* (Pers.) Jens.]

Phytopath. Z. 1935 : 8 : 253-58.

In order to discover whether the *U. tritici* prevalent in Rumania comprised races differing in pathogenicity, 15 samples of smut from various parts of Rumania—7 from winter and 8 from spring wheat—and also 2 from Halle and Zidlochovice in Czechoslovakia were tested on arbitrarily selected collections of winter and spring wheats.

From the winter wheat tests it was not possible to reach any certain conclusion as to the existence of physiological races. This result the author is inclined to interpret as indicating that smut of winter wheat in Rumania exhibits no marked differences in pathogenicity.

On the other hand three physiological races were clearly demonstrated in the smut of spring wheat in Rumania and one was found in smut material from Czechoslovakia.

The results are compared with those of Grevel ("Plant Breeding Abstracts," Vol. I, Abst. 55) and his assumption that race 4 (corresponding to race 3 in the present experiments) has become specially adapted to *durum* wheats is confirmed.

The necessity for increasing the number of wheats to compose a constant-standard test collection for use in future work is emphasized.

111. SCHILCHER, E. 632.452:576.16:633.11(43.6)
Beitrag zur Rostfrage. (II. Mitteilung.) [On the rust problem. (II. Communication.)]
Z. PflKrankh. 1935 : 45 : 316-35.

An investigation of the physiological forms of *Puccinia triticea* and *P. glumarum* prevalent in Austria.

From the samples received and examined during 1932, 1933 and 1934 forms XIII, XIV, XV, XVI, XX and XXI of *P. triticea* were isolated.

Nearly all wheats grown in Austria, whether improved or land varieties were markedly susceptible to the biotypes found in that country.

In years unfavourable to infection varieties otherwise susceptible may prove resistant.

112. RONSDORF, L. 632.452:576.16:633.16
Weitere Untersuchungen über den Nachweis biologischer Rassen des Gerstenzwangrostes [sic. ? Gerstenzwergrostes], *Puccinia simplex* Erikss. et Henn. (Further investigations on the demonstration of the existence of biological races in dwarf rust of barley, *P. simplex* Erikss. et Henn.)
Phytopath. Z. 1935 : 8 : 237-43.

Two experiments were made to ascertain (1) the reaction at 12°C. and 22°C. of races II, III, IV, V, IX of *P. simplex* of German origin towards the Mains standard test collection of barleys and (2) the reaction of biological races from America to Hey's test collection.

The results demonstrated that in the present instance low temperature mostly increased the degree of susceptibility but rarely lowered it; moreover the Mains collection was incapable of distinguishing the five races of dwarf rust tested. This raises the question of whether there are not actually more than the two physiologic forms of *P. simplex* so far recorded in America.

The second experiment shewed that by Hey's test collection it was possible to identify two, if not three races of *P. simplex* derived from three monosporidial lines from one sample of rust material from America.

Hey's test collection is regarded as superior in value to that of Mains.

113. HAYES, W. P. 632.7:576.16:631.521.6
Biological races of insects and their bearing on host plant resistance.
Ent. News 1935 : 46 : 20-23.

In briefly reviewing the problem of breeding varieties resistant to, or better still, in the opinion of some, tolerant of insect pests, the author refers to certain pests, such as the European corn borer, *Pyrausta nubilalis* Hbn., in which different races, differing in their feeding habits, are now known to exist. Two such races of the corn borer are known, one much more limited in its choice of hosts than the other and producing only one generation instead of two a year; two races are also known in the Hessian fly, *Phytophaga destructor* Say., again differing in their power to attack the various wheat varieties, and the two races usually occur together. The existence of such races is an important point to be taken into account in breeding for resistance.

114. DRAIN, B. D. and SHUEY, G. A. 632.951.1-1.532.3:575.42
The isolation and propagation of high pyrethrin strains of *Pyrethrum*.
 Proc. Amer. Soc. Hort. Sci (1934) 1935 : 32 : 190-91.

From the strains introduced as seeds from other countries varying percentages of pyrethrin were obtained. High-yielding plants were propagated by crown-division, which appears the most feasible method of vegetative propagation and the results indicate that pyrethrin content, while possibly influenced by environmental characters is also more or less genetic in nature.

ECONOMIC PLANTS 633

115. DIEHL, R. 633:575
 Les facteurs génétiques de la qualité dans la production végétale. (**The genetic factors for quality in plant production.**)
 Ann. Agron. Paris 1935 : (N.S.) 5 : 219-39.

The difference between characters conditioned solely by genetic factors and heritable characters capable of modification by environment is explained by references to inheritance in wheat, oats, barley, potatoes and sugar beet. In order to counterbalance or turn to account the influence of environment in plant breeding, the production, if possible, of either highly adapted or extremely adaptable varieties is recommended. A combination of superior quality with high yield is regarded as attainable by a careful system of breeding.

116. 633:575
 VAVILOV, N. I. 633:575.127
 (**Main problems of Soviet plant breeding and methods of solving them.**)
 Bull. Appl. Bot. Leningrad 1934 : Ser. A (12) : 5-22.

A repetition of the article reviewed in " Plant Breeding Abstracts " Vol. V, Abst. 629.

117. NILSSON-EHLE, H. 633:575(48.5)
Swedish plant-breeding.
 Anglo Swedish Rev. 1935 : 166-67.

An outline of the successful work on cereal breeding carried out at Svalöf and Weibullsholm in breeding cereals for high yield, winterhardiness, earliness, stiffness of straw and quality. Further progress is expected from the continued application of selection and the principles of genetics. Attempts are being made to produce new types of economically useful plants by increasing the chromosome number—a method already successfully applied in sugar cane breeding. The method of induced mutation has so far failed to produce any valuable new forms. Two new institutes are being planned, one for the breeding of forest trees with special reference to quality and the other for breeding fruit trees. Genetic work with vegetables is in progress and is to be extended.

118. 633:575(73)
" Who's who " among the genes.
 J. Hered. 1935 : 26 : p. 248.

Plan for a catalogue of the best existing strains of plant (and animal) life, to be compiled by United States Department of Agriculture.

119. NAVASHIN, M. 633:575:575.129:581.163
(A new possibility in breeding.)
 J. Bot. URSS. 1934 : 19 : 402-08.

The author suggests that artificial parthenogenesis followed by artificial creation of a diploid from the haploid formed is a possible method of creating pure lines, thus avoiding the selection of millions of plants which is necessary under the normal conditions of pedigree breeding. The advantage that would accrue by applying the method to a hybrid shewing pronounced heterosis, and so obtaining a homozygous line containing all the dominant yield factors, serves as an example.

120. BOGORODSKIJ, M. A. 633:575:578.08
 (On the article of M. Navashin "A new possibility in breeding.")
 J. Bot. URSS. 1934 : 19 : 409-13, 414-15.

The author agrees with Navashin that the ordinary method of pedigree breeding, involving as it does the examination of millions of individuals before the desired type is produced, is far too long and complex for practical purposes when making any but the simplest combinations of characters. He recognizes the possibilities of the method suggested by Navashin but also points out that the method of bulk sowing followed by selection of homozygotes only in later generations is also much simpler than the pedigree method, involves smaller quantities of material and so permits the breeder to work with a larger number of crosses at a time. A table is given shewing the difference in the probability of obtaining homozygous forms by selection in the later generations and in the second generation, i.e. by the methods of bulk populations and pedigree breeding respectively. In monohybrid populations the difference in favour of the method of bulk populations is low, the probability being only twice that for the pedigree method ; but the difference rises with the number of factors for which the population is segregating ; thus in a hexahybrid population the probabilities are 64 times greater in the method of bulked populations in self-pollinated plants and 34.8 times even with 20 per cent cross-pollination. Even the desired homozygous dominant in the case of heterosis could in all probability be obtained by repeated sowings of the bulked populations, especially if the heterozygotes are removed in each generation. Various cases of successful application of the bulk population method are instanced and breeders are urged to give it at least a trial.

Dr. Navashin in turn admits the value of the bulk population method pointing out that with large numbers of segregating factors the population after 9-10 generations consists almost entirely of homozygotes. Nevertheless, he remarks, the time required to attain this is considerable, and even still the proportion of each different factorial combination in the resulting population will be only 3 per cent in a pentahybrid and 0.1 per cent in a decahybrid. The chances of obtaining the desired combination therefore remain extremely low ; and the chances of losing just the combination we desire are extremely high. This notwithstanding, the method is admitted as one of great promise and indeed in many cases the only feasible one.

121. GORŠKOV, I. 633:575:631.557
 (Breeding a potent method in the campaign for high yield.)
 Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow.
 I. V. Michurin 1934 : No. 1 : 7-8.

A plea is made for the still greater application of the results of breeding by the practical growers and for the greater utilization of the natural resources of the Soviet Union in cultivation and in breeding work. Special problems suggested for the breeder are the production of a sweet chestnut for flour, of cold resistant forms of tea, mandarin oranges and other subtropical plants, following the admirable lead given by Michurin, and of ultra-hardy and early maturing varieties for Siberia and the Urals, again following Michurin's lead.

Among the achievements of the Soviet breeders the *Triticum-Agropyrum* hybrids are referred to for their remarkable hardness and high yields, giving two crops a year of good quality grain in more southerly regions. Lastly reference is made to the advantages of vernalization.

122. FRIMMEL, F. 633:575.1
 Applikation wissenschaftlicher Beobachtungen auf dem Gebiete gärtnerischer
 genetischer Versuche. (Application of scientific observations in the sphere
 of horticultural genetic experiments).
 Otáz. Zemed. 1935 : 47 : 14-17.

Attention is drawn to the importance of combining scientific methods with the practical economic aims of plant breeding.

In fruit culture the prevailing tendency to strive for uniformity in the varieties used introduces the problems of sterility and also the loss of so-called superfluous varieties containing valuable genes ; and it is suggested that a museum of live specimens of such varieties should be maintained. In strawberry breeding the frequent degeneration phenomena call for a continual supply of

new forms produced by breeding. The importance of breeding for immunity is also pointed out. Though in the case of self-fertilizing plants such as beans, peas and tomatoes, such a wealth of variants as can be obtained from vegetatively reproduced plants is impossible, nevertheless hybrids characterized by heterosis phenomena can be bred in addition to new pure lines. Such hybrids can of course also be produced from cross-fertilizing plants.

The cause of heterosis is thought to lie in a physiological stimulus of the vitality of the embryo, due to the differences in the plasma of the two parent plants.

Various methods of utilizing variants to form varieties, including the Miss America isolation technique, are touched upon.

The difficulty involved in breeding for complex economic characters is mentioned and the role of genetics in practical breeding is held to be the analysis of the internal relationships underlying such characters.

123. JESWIET, J. 633:576.16
De studie van de herkomst der cultuurgewassen. (**The study of the origin of cultivated plants.**)

Landbouwk. Tijdschr. Wageningen 1935 : 46 : [47] : 139-43.

A report of a lantern lecture describing the functions and the past and present methods of the botanist, geneticist, archaeologist, historian, and philologist in tracing the original habitats and when possible, the primitive or original forms of cultivated plants. Botanical investigations are regarded as being the most helpful method of approaching such problems. In the author's opinion, collections, as complete as possible, of clones or races of all the important cultivated plants of the world should be maintained and would be of great use both in drawing up descriptions of forms and in hybridization work.

124. SKAZKIN, F. D. 633:576.341:581.48
(**Osmotic pressure of the seed as a criterion of the drought resistance of plants.**)

Bull. Appl. Bot. Leningrad 1934 : Ser.A (12) : 103-12.

The results of the various authors who claim that the osmotic pressure of the seed is a constant racial character, indicative of the nature of the mature plant arising from it, and can be used as a measure of its drought resistance and other characters are reviewed. The views of various critics of the method are then presented and the conclusion is reached that in the first place the method of germinating in sugar solutions does not give a true indication of the osmotic pressure of the seed, nor does it give a reliable figure for the variety, constant over a number of years. The figure obtained moreover is not directly correlated either with the drought resistance or cold resistance, yield or earliness ; nor is it a reliable criterion of the purity of the material. The osmotic pressure of a variety is influenced by the conditions of growth and may vary even within a "pure" line. To be of any real value the method requires considerable further study and refinement.

125. SNELL, K. 633-2-1.521.6(43)
Die Bewertung der Sorten von Kulturpflanzen nach ihrer Widerstandsfähigkeit gegen Krankheiten. (**The evaluation of varieties of cultivated plants according to their resistance to diseases.**)

NachrBl. dtsh. Pflanzenschutzdienst 1935 : 15 : 13-14.

A brief enumeration of the work that is being done by German Institutes and workers in evaluating the resistance of crop plants to various diseases. Up to the present, only in one case, namely potato wart disease, is resistance an essential condition for official approval of a variety. It is hoped that the technical difficulties in the way of testing varieties for various diseases with sufficient rapidity may be overcome so that disease resistance of various crops may be included in the work of evaluating varieties.

126. MOSCHKOV, B. S. 633-2.111-1.521.6:581.143.26.035.1
Photoperiodismus und Frosthärte ausdauernder Gewächse. (**Photoperiodism and frost resistance of perennial plants.**)
Planta 1935 : 23 : 774-803.

The material used for this study comprised species of *Robinia*, *Juglans*, *Prunus*, *Thea*, *Rubus*, *Salix*, *Vitis*, *Ribes*, etc.

It was found that frost resistance of perennials is dependent on the photoperiodic conditions to which they have been subjected during growth, and by altering these conditions the frost resistance of a given species may be either increased or decreased at will within genetically determined limits.

Regarded from the standpoint of natural and artificial selection frost resistance appears to be a secondary character which is often dependent on conditions prevailing during vegetative growth and especially the photoperiodic conditions found most suitable by the individual plant forms. It is emphasized that each species and even each clone within a species may have its own particular photoperiodic requirements, which have already played their part in natural selection and the origin of the form in question.

Points of technique and its practical applications are discussed.

CEREALS 633.1

127. SANDO, W. J. 633.1:575.127
Hybrids of wheat, rye, *Aegilops* and *Haynaldia*. A series of 122 intra- and inter-generic hybrids shews wide variations in fertility.
J. Hered. 1935 : 26 : 229-32.

A list is given of 122 intra- and inter-generic hybrids of *Triticum*, *Secale*, *Aegilops* and *Haynaldia* made by the writer, and the fertility of certain of the F_1 's is reported.

128. OORT, A. J. P. 633.1-2.451-1.521.6:575
Literatuuroverzicht over Plantenziekten. (**Survey of literature on plant diseases.**)
Landbouwk. Tijdschr. Wageningen 1935 : 47 : 355-58.

Brief abstracts of papers (already reviewed in "Plant Breeding Abstracts") on the inheritance in cereals of resistance to smut and on physiological forms of the latter are included in this survey.

WHEAT 633.11

129. POSTELT. 633.11:575(43)
Bemerkenswerte So.-Weizen-Neuzüchtungen. (**Newly bred spring wheats worthy of attention.**)
Dtsch. landw. Pr. 1935 : 62 : p. 102.

The Württembergische Landessaatzuchtanstalt Hohenheim has produced two new spring wheats, Frankenweizen and Alemannenweizen. The former is suited for conditions of intensive cultivation, the latter for good, porous chalky soils. Tests over the last two years have shewn the superiority of these two new wheats over the old Hohenheimer and a number of other standard varieties ; the former they have surpassed in yield by an average of 10 and 9 per cent respectively. They are also superior in standing capacity, which in Franken is particularly good, and on account of their rapid early growth escape the attacks of insect pests. Their baking quality is also satisfactory.

130. PAPADAKIS, J. 633.11:575(49.5)
L'amélioration du blé en Grèce. (**Wheat improvement in Greece.**)
Sélectionneur 1934 : 3 : 146-65.

After the establishment in Greece of a central Institute for the improvement of wheat with a chain of sub-stations, a number of foreign wheats, e.g. Canberra, Hard Federation and Mentana were introduced and their adaptability to Greek conditions and its various ecological regions studied ; and ultimately Canberra and Mentana were found suitable for cultivation on a wide scale.

Pure lines of local populations were also obtained yielding in some districts 40 per cent more than the local wheats grown. A number of selections from local *durum* and *vulgare* types, e.g. Mykiné, Xyloastro, Eretria, Argos, Agamemnon and Minos, specially suited to certain regions proved promising in yield and quality, even when compared with Canberra or Mentana.

In order to eliminate defects in regard to drought resistance and lodging, the above mentioned selections were used in numerous crosses with imported varieties and with hybrids obtained from a successful Florence x Ardito cross and a Kentradi x *Triticum villosum* cross (T-3130) and certain other varieties. The last named hybrid showed no segregation and morphologically resembled the female parent; but its physiological dissimilarity suggests that an exchange of certain chromosomes has taken place.

Many of the progenies of these crosses appear to possess earliness, resistance to drought, to *Puccinia graminis* and to heat injury, though they as yet lack the xerophilous characteristics and especially "alkalophily" which is found in Mentana. "Xerophily" and "alkalophily" are, it is thought, possible recessives or due to the absence of several factors one of which when present produces the opposite characteristic.

A number of *durum* x *vulgare* crosses were made and, from two different interspecific crosses, one exceptional form was obtained with the ear bearing spikelets on all sides. One of these anomalous plants selected in F_2 proved homozygous in F_3 and is to be cytologically examined.

Hybridizations are also in progress to produce an early cold-resistant variety for Western Greece.

In making selections from the crosses two methods were used, namely pot experiments with various types of soils and "pocket" experiments (in which three grains are sown per "pocket" measuring 0.50 x 0.50 [metres]) and a single plant is retained; and it was found that by this means large numbers of plants could be tested much more adequately and rapidly than by the usual methods.

633.11:575(61.1)

633.1:575(61.1)

131. BOEUF, F.

Improvements in cereal production in Tunis.

Mon. Bull. Agric. Sci. Practice Int. Rev. Agric. 1935 : 26 : T305-24.

A brief resumé of the history of cereal breeding which began in 1906 in Tunis is followed by a description of wheat breeding and brief notes on barley and oats.

In spite of the efforts of the Botanical and Agronomical Service to improve the hard wheats grown by breeding local varieties and imported varieties and by intraspecific or interspecific crosses much still remains to be done in increasing productivity, earliness and resistance to blast, spotting, lodging and rust.

The two primary desiderata in soft wheats for Tunis are early maturity and resistance to drought and much selection and breeding work has been done along these lines with imported, French, Italian, Australian and other wheats. Numerous hybrids are being tested, work being concentrated on 5 or 6 varieties representing 2 commercial types.

The technique used in improvement is described and also the lines on which the necessary ecological and agronomic investigations (including soil fertility) are carried out. Plant and animal pests of wheat, including the study of physiological forms of fungi and the varietal susceptibility of Tunis wheats, of baking value by Chopin's extensimeter and other methods, the preservation and finally the testing of purity of seeds all form part of the official campaign of active research to promote wheat improvement.

The selection of barley which also began in 1906 was interrupted by hostilities but it is to be taken up again in the coming year.

Of oats, a secondary cereal in Tunis, the only varieties grown belong to *Avena algeriensis* first imported from Algeria and recently from Australia. Pedigree selection has somewhat improved the Algerian importation. From the descendants of numerous crosses between *A. algeriensis* and *A. sterilis* white, yellow, cream, grey and black lines have been segregated out, but the work has now been suspended. The Australian *A. algeriensis* is undergoing tests in the regional experiment fields.

An extensive bibliography of the publications of the Botanical and Agronomical Service on cereal improvement in Tunis is provided.

132. FLAKSBERGER, K.

633.11:575.1(47)

(What has been done by Soviet scientists in the study of wheat in recent years.)

Bull. Appl. Bot. Leningrad 1934 : Ser.A(12) : 65-69.

A brief review is given of the numerous advances in the knowledge of the genus *Triticum* made by Soviet scientists. *Inter alia* reference is made to the discovery of a number of new species, including *T. persicum*, which replaces *T. durum* at high altitudes of over 900 m. and may be a useful substitute for it in northern zones; and also to *T. Timopheevi*, of interest on account of its exceptional resistance to diseases and pests, and a number of others, including some new wild species. Innumerable new characters and combinations of characters have been discovered, many of them endemic in particular limited areas. Two main centres of distribution for the different groups have been established.

In addition to this the wheats of the entire world have been amassed and the greatest wheat collection in the world now exists in the Soviet Union, serving as an invaluable fund of material for selection and synthetic breeding. The type and range of phenotypical variability of the different types has been established for the first time by elaborate repeated sowings in widely separated and different geographical areas.

The interrelationships of the species have been shewn to be much more complex than was hitherto suspected and as a result of detailed systematic and genetic studies these have been established on a firmer basis. The author has contributed largely to this work and is publishing a new classification in which each species is sub-divided into subspecies and proles, i.e. into morpho-ecological groups.

One of the most important world discoveries, namely that of vernalization, has already been made by a Soviet botanist mainly working with wheat.

133. VACENKO, A. A.

633.11 *T. durum*:575.116.1(Inheritance of glume pubescence and of the black colour of the ear in *durum* wheat.)

C.R. Acad. Sci. URSS. 1934 : 4 : 338-43.

The varieties of *Triticum durum* with black ears are characterized by a less dense glume pubescence than those with white or reddish ears, and no exception to this rule has been found amongst a large number of local Ukrainian wheats examined. Data are here given of a cross made in 1925 between these two types; the F_1 was black and densely pubescent, and in the F_2 three types were obtained as follows: (1) black ears with sparse pubescence; (2) black ears with dense pubescence and (3) white with dense pubescence, in the ratio of 31:59:36, i.e. very nearly 1:2:1. Both black coloration and dense pubescence when examined separately in the F_2 gave 3:1 ratios. Types (1) and (3) bred true in F_3 , while the plants with black ears and dense pubescence all segregated as in F_2 .

A further cross was made in 1930, using as parental varieties one with white glabrous ears, the other with black ears and sparse pubescence. The F_1 was of the latter type and four types were obtained in F_2 , namely (1) black with sparse pubescence, (2) white sparse, (3) black glabrous and (4) white glabrous, in the following proportions: 291:4:2:92. The two characters are thus seen to be dependent on distinct genes which are closely linked, with a cross-over percentage of 2.4 per cent. The cross-over forms have also recently been found in nature.

A further cross between a glabrous and a densely pubescent form shewed pubescence to be incompletely dominant.

An analysis of the weight of grain per ear, the grain weight and the number of undeveloped spikelets for the different phenotypes from the first cross indicated that the homozygous form with black ear and sparse pubescence was inferior and this is evidently why so few of this type have appeared amongst selected varieties.

134. MATHER, K.

633.11:575.127.2:576.356.5:576.354.46

Chromosome behaviour in a triploid wheat hybrid.

Z. Zellforsch. 1935 : 23 : 117-38.

The hybrid was a cross between *Triticum dicoccum* which usually has 14 bivalents at meiosis, but occasionally produces quadrivalents and *T. monococcum* which usually has 7 bivalents but occasionally has two univalents, owing to the failure of chiasma formation. Metaphase pairing in the triploid hybrid was variable, 0-3 trivalents being formed (one or two being very common), 3-7 bivalents and 6-12 univalents. The trivalents were all either the chain type or (more rarely) the rod ring type, never the Y type, suggesting that zygotene pairing may be polarised. When two trivalents occur in the same nucleus they always belong to two classes with respect to the position of the spindle attachment insertions, leading to the conclusion that there are two trivalents occurring fairly regularly and a third only occurring rarely. They nearly always disjoin so that the centre chromosome goes to one pole and the two end ones to the other; when there are two their disjunction with respect to each other is at random.

The univalents are distributed at random throughout the cell at metaphase I, but at the anaphase some, but not all, come on the plate and divide; these come on to the plate at anaphase II without dividing, first lying transversely to the spindle and then later directing their ends towards the poles, evidence in support of Belar's claim that the spindle contracts in the plane of the plate at anaphase. A number of micronuclei are formed by the univalents which do not reach the poles at anaphase II.

The formation of quadrivalents and even higher associations at metaphase I in the hybrid indicates the presence of structural hybridity, probably simple, terminal translocations, while unclean separations (chromatin bridges) observed at anaphase indicate the presence of inversions.

The chiasma frequencies of the parents and hybrid were analysed. The terminalization coefficients of the three were sufficiently alike to allow of comparisons being based on counts at metaphase. It was found that there was a slight difference, of doubtful significance, between *dicoccum* and *monococcum*, but a marked reduction in the hybrid as compared with either parent.

The chiasma frequencies obtained from fixations of different hybrid plants on different days were subjected to Fisher's analysis of variance, and it was found that there were significant differences between different days, but not between different plants on the same day; the same result was obtained with *T. dicoccum*, and it is suggested therefore that the environment plays an important part in causing variations in chiasma frequency. Since chiasma formation conditions metaphase pairing, it might be expected that the latter would shew a corresponding variation in the hybrid from day to day, but on analysis this was found not to be the case, shewing that chiasma formation was not the limiting factor in determining metaphase pairing, and hence that the effective pachytene pairing is incomplete, the effective pairing being that which can be followed by the formation of chiasmata, and being presumably between homologous parts only. It follows also that there cannot be a simple linear relation between the length paired at pachytene and the frequency of chiasma formation.

In discussing the results in relation to chromosome differences between the species, the author points out that the trivalents are most satisfactorily explained as made up of two *dicoccum* and one *monococcum* chromosomes, and the bivalents as allosyndetic; the structural hybridity mentioned above, however, must in view of the meiotic behaviour of the parent species, be ascribed to structural differences between *monococcum* chromosomes and those *dicoccum* chromosomes with which they normally pair. The reduction of chiasma frequency in the hybrid shews that less than 0.7 of the total length of the *monococcum* chromosomes are homologous and pair with those of *dicoccum*. From the regularity of terminalization it may be concluded that the homologous sections are located near the ends of the chromosomes and are long. It is concluded that one ancestor of *T. dicoccum* must have been nearly related to the ancestor of *T. monococcum*, while the other was also related but more distantly. The differentiation of the chromosomes of the two species has proceeded (1) by gradual change, resulting in a certain amount of non-homology and (2) by structural changes such as inversion and translocation, as shewn by the structural hybridity found in the hybrid.

135. KIHARA, H. 633.11:575.127.5:633.11 *Aegilops*
Genomanalyse bei *Triticum* und *Aegilops*. (Analysis of the genom in
Triticum and *Aegilops*.)

KIHARA, H. and LILIENFELD, F.

VI. Weitere Untersuchungen an *Aegilops* x *Triticum*- und *Aegilops* x *Aegilops*-
Bastarden. (Further investigations with *Aegilops* x *Triticum*- and *Aegilops*
x *Aegilops* hybrids.)

Cytologia 1935 : 6 : 195-216.

The preliminary results of numerous wheat crosses namely (1) diploid, (2) triploid, (3) tetraploid, (4) pentaploid and (5) hexaploid are discussed.

Among the diploids *T. aegilopoides* x *Ae. squarrosa* and *Ae. speltoides* x *Ae. caudata* are probably hybrids whose genomes differ more or less in all their components.

The F₁ hybrid *T. aegilopoides* x *Ae. squarrosa* gave 3 grains, 2 of which produced vigorous plants, numbers 1 and 2 closely resembling each other and *T. aegilopoides*; from this it is deduced that they both arose from egg cells with the *aegilopoides* chromosome genom. Plant No. 1 behaved normally as regards dehiscence of the anthers, the formation of good pollen and fertility. Plant No. 2 on the other hand was markedly inferior in these respects and was highly sterile owing to defective pollen. These differences were confirmed by the cytological behaviour observed in regard to chromosome pairing and reasons are given for the suggestion that the egg cell from which No. 2 arose may have had 6 *T. aegilopoides* chromosomes and 1 *squarrosa* chromosome, though other explanations are also considered. But the problem of whether one complete genom of one of the parent forms is essential for the formation of functional hybrids must remain undecided; it is interesting to note that contrary to the general finding the reciprocal cross *Ae. squarrosa* x *T. aegilopoides* gave no grains capable of germination.

In the *Ae. comosa* x *Ae. mutica* and *Ae. comosa* x *Ae. squarrosa* crosses pairing in general was not too irregular and 7 associations were most commonly found, though whether they represented truly homologous partners is not known. Most of the chromosomes must, however, correspond fairly well.

The triploid crosses *T. durum* x *Ae. mutica* and *Ae. caudata* x *T. durum* shewed similar chromosome relations to that of the *Ae. Aucheri* x *T. durum* cross (cf. "Plant Breeding Abstracts," Vol. III, Abst. 380) from which it is evident that the *mutica* and the *caudata* genom are in many respects partially homologous with the wheat genomes A and B.

The tetraploid cross *Ae. caudata* x *T. vulgare* shewed that the *caudata* genom is not homologous with the *vulgare* genom.

Ae. triaristata was found to contain none of the three wheat genomes, A, B or D.

From a number of pentaploid crosses comprising *Ae. crassa*, *Ae. ovata* and *Ae. ventricosa* it seemed probable that one of the three *crassa* genomes corresponds to a very similar or homologous (or almost homologous) genom in *Ae. ovata* or *Ae. ventricosa*. Moreover since both the latter species have one approximately similar genom, the C-genom, hence in *Ae. triaristata* it may be merely a case of a modification of this genom which is common to so many *Aegilops* species. (Cf. "Plant Breeding Abstracts." Vol. III, Abst. 380.)

136. SOROKINA, O. N. 633.11:575.127.5:633.11 *Aegilops* (016)
(Hybridization of *Aegilops* with wheat.)
Bull. Appl. Bot. Leningrad 1934 : Ser.2(6) : 7-36.

The study of *Triticum* x *Aegilops* hybrids is reviewed from the time of the first discovery of *Ae. triticoide*s by Requien in 1821. The material reviewed is dealt with under the following heads : percentage success in crossing ; fertility of hybrids ; cytology of hybrids ; and the phylogenetical relationship between the species of *Triticum* and *Aegilops*. The results of the various authors, together with their conclusions, are analysed somewhat extensively and the article terminates with a full bibliography.

137. ARTEMOVA, A. 633.11:575.127.5:633.289
(Hybrids of wheat and *Agropyrum*).

Semenovodstvo (Seed Growing) 1935 : No. 5 : 37-40.

Three species of *Agropyrum* have been crossed without difficulty with wheat at Saratov, namely *A. intermedium*, *A. trichophorum* and *A. elongatum*. The percentage success on pollinating hard or soft wheat with these species varied from 1.0 to 96, depending on the parental strains, the average being 50 per cent. The *Agropyrum* characters are mainly prevalent in the F_1 plants, which are very luxuriant, forming as many as 150 heads on one plant. Segregation has been observed in the F_1 generation for habit, awning, colour of ears, etc. and indicates the heterozygosity of the *Agropyrum* parents.

The F_1 hybrids are described in four groups, the first of which, from crosses of *T. vulgare* with *A. elongatum*, is distinguished by high fertility and sets seed by self-pollination when bagged. One such plant in the cross with *A. elongatum* gave as many as 665 grains. The degree of fertility is entirely dependent on the strain of wheat used in the cross.

The second group, from *T. durum* with the other two *Agropyrum* species, is generally much lower in fertility and only in the case of certain *T. durum* strains does the fertility approach that of the first group.

The third group consists of hybrids of soft wheat with *A. intermedium* and *A. trichophorum* and has only rarely formed grain, whilst the fourth group, from *T. durum* and *A. elongatum*, is the least fertile of all.

Between four and five thousand hybrids were grown and all were perennial in habit and fully frost-resistant. In the latter respect the hybrids of *A. elongatum* surpassed the other two groups. Wide segregation was observed in the second generation from *A. intermedium* and *A. trichophorum*, the majority of the segregates being intermediate in type between the two parental species. The fertility however was higher than in the F_1 and the grain was large, vitreous and intermediate in form; 50 per cent of the F_2 plants were perennial. On the other hand the F_2 generation from the *A. elongatum* crosses obtained almost entirely from self-pollination of the F_1 , consisted almost exclusively of plants of the *Agropyrum* type, with a few intermediate but no wheat types. All varying degrees of fertility were encountered; 90 per cent of the plants were perennial and the grain also was of the *Agropyrum* type.

The third generation of the crosses with *A. intermedium* and *A. trichophorum* was still very varied, with a considerable preponderance of the wheat type; there was a still further advance in fertility, and many plants were possessed of quite normal fertility. The grain also was mainly of the wheat type, heavy and vitreous, having a thousand corn weight of 22 g. The number of perennial forms was reduced however to 5.0 per cent.

Later generations are present for one cross only, *lutescens* 62 x *A. intermedium*. In this cross the F_4 , F_5 and F_6 contain entirely wheat-like plants, though segregation is still evident. A gradual rise in fertility up to normal in F_6 is also observable, the grain being like ordinary soft wheat. All the hybrids are spring forms, some of them are resistant to rust and smut and in addition to being free from shattering are possessed of a number of other valuable agronomic characters. The cross *Triticum* x *Agropyrum* is thus considered one of the greatest practical and theoretical possibility.

138. VERUSCHKINE, S. M. 633.11:575.127.5:633.289
(On the hybridization of *Triticum* x *Agropyrum*).

People's Commissariat Agric. USSR. Saratov 1935 : Pp. 39.

The earlier examples of *Triticum* x *Agropyrum* hybrids are discussed and the conclusion reached that the specimen used by Tzitzin (see "Plant Breeding Abstracts," Vol. V, Abst. 78) under the name *A. intermedium* must have been in reality *A. lolivoides*, since *A. intermedium* is in every way similar to *A. glaucum* and is in the present work regarded as synonymous with it. The three species here considered are therefore *A. elongatum*, *A. intermedium* and *A. trichophorum*, all of which cross with ease both with hard and soft wheats. The success varies very much with the choice of parental forms, the average being 50 per cent, but rising in certain combinations to as much as 90 per cent. Crosses were made in 1932 of *A. elongatum* with *T. sphaerococcum*, *T. compactum*, *T. turgidum* and *T. persicum* and in 1933 of *A. intermedium* with *T. monococcum*, *T.*

dicoccoides, *T. dicoccum*, *T. polonicum*, *T. persicum*, *T. compactum* and *T. sphaerococcum* and of *T. dicoccoides* with *A. elongatum*. Thus these two species have been crossed with all three sections of the genus *Triticum*.

The *Agropyrum* characters are largely dominant in the F_1 especially in the crosses of *A. elongatum*, though the degree of this dominance varied in different parental combinations. Segregation occurred for a number of characters, indicating that the *Agropyrum* parents were heterozygous. All the F_1 hybrids were perennial and many of them shewed heterosis, being more luxuriant than the *Agropyrum* parent.

The hybrids of *T. vulgare* x *A. elongatum* were the most fertile, many of them even giving a quite normal set of grain by self-pollination when bagged. Some of them gave very high sets of 80 to 100 per cent also on pollinating with wheat. By open pollination some plants produced as many as 500 grains.

The fertility in the hybrid *A. intermedium* x *A. trichophorum* was distinctly less; very few plants set grain by self-pollination and the average set by free pollination was 2.5 per cent and by artificial pollination 7.5 per cent. The fertility in the hybrids *T. vulgare* x *A. intermedium* and x *A. trichophorum* were almost the same on self-pollination, but slightly less on artificial pollination. The lowest in fertility were the hybrids of *T. durum* x *A. elongatum*, in which there was no self-pollination and only a very low set by artificial cross-pollination.

There is thus a much greater affinity between *A. elongatum* and *T. vulgare* than between the first named species and *T. durum*. The other two *Agropyrum* species shewed slightly more affinity with *T. durum* than with *T. vulgare*, though the difference in this case was not so marked. However, within all these groups the different parental combinations were entirely different in fertility, both in the first and later generations, and the success of the cross depends entirely on the choice of the most suitable parents. The later generations are obtained on a large scale by planting wheat in between the rows of the hybrids. The second generation displayed wide segregation, a greater number of characters of the wheat type being present; the fertility of all hybrids was higher than in the F_1 . A considerable number of annual forms appeared in this generation, about 43 per cent in the crosses with *T. vulgare* and 66 per cent in those with *T. durum*. The grain was intermediate in type between that of the two parents.

The F_2 of *T. vulgare* x *A. elongatum* differed from the others in several respects: firstly there was a distinctly higher proportion of perennial forms, which constituted up to 96 per cent of the population; 30 per cent of the population also failed to ear when sown in spring. The other characters of the *Agropyrum* parent are also more pronounced. As regards fertility great variation was observed, some plants having as many as 3.2 grains per spikelet; the grains were more or less of the *Agropyrum* type. The third generation of this cross was not available for examination but that of *Triticum* x *A. intermedium* and *A. trichophorum* shewed even greater diversity, with a tendency still further to approach the wheat type. The majority were spring forms and only 5 per cent were perennial; the fertility was greatly increased and the grain often of the wheat type. This approximation to wheat was still more evident in the fourth generation and only very occasional perennial plants occurred.

The F_5 - F_7 generations are available only for one cross, with *lutescens* 62; they consist of a wide variety of forms in none of which however does the variation go beyond the limits of the wheat type and no perennial forms have been observed. The fertility is normal and in some cases unusually high. Some of the families are marked by entire freedom from attack by rust or smut and altogether this material is regarded as having very great practical possibilities, especially the hybrids of *T. durum* with *A. intermedium* and *A. trichophorum*.

Many of the hybrids of the F_2 - F_5 generations which in the field behaved as annuals when grown in the hothouse behaved as typical perennials. Others behaved as annuals both in the field and in the hothouse, so that in the process of segregation we obtain true annual plants, true perennial plants and a number of intermediates which in one set of conditions give one type of behaviour and in other conditions the other. There is every reason to believe that the third group if grown in a mild climate would be perennial even in the field.

With the object of elucidating the relationships of these species of *Agropyrum* attempts were made to cross them also with other allied genera. *A. intermedium* was crossed successfully with a number of species of *Aegilops*, with quite high percentage successes. The hybrids were perennial,

intermediate in character between the two species and partially self-fertile. There can be no question therefore of the close relationship between this group of *Agropyrum* species and the two genera *Triticum* and *Aegilops*; there is even reason to suppose that its relation to *Triticum* is closer than that of *Aegilops*. Hybrids were also obtained from *Secale cereale* pollinated by *A. intermedium*, 40 hybrid grains being produced from 115 flowers pollinated. The hybrids are however sterile but their existence shows the relationship also of *Secale* with the genus *Agropyrum*. On the other hand no success has been obtained in attempts to cross other species of *Agropyrum* with wheat, although one variety of *A. cristatum* has been crossed successfully with rye. The cross *A. intermedium* x *A. elongatum* has, moreover, proved successful, whereas *A. repens* x *A. intermedium* has failed. *A. intermedium* and *A. trichophorum* apparently cross in nature. All these facts still further substantiate the unity of this group of *Agropyrum* species and its distinctness from the rest of the genus.

139. SAPEHIN, A. A. 633.11:575.127.5:633.289:576.356
(Cytological investigation of *Triticum* x *Agropyrum* hybrids.)
J. Bot. URSS. 1935 : 20 : 119-25.

Examinations were made of F_1 hybrids of *Triticum vulgare* with *Agropyrum elongatum* and *A. glaucum* made by M. I. Saltykovskii. In contradistinction to the results reported by Vakar (see "Plant Breeding Abstracts," Vol. V, Abst. 969) the hybrid *T. vulgare* x *A. elongatum* had 21 bivalents and only 7 univalents. The race of *A. elongatum* here used has 56 chromosomes and not 70 as Vakar's race. The various meiotic irregularities occurring at first and occasionally second metaphase are described and illustrated. These were not extreme and the race of *A. elongatum* used is considered very promising for breeding purposes.

The other hybrid, with *A. glaucum*, was extremely irregular at meiosis; the number of bivalents was rarely greater than two, occasionally three, in spite of the chromosome number of the parents being the same. The formation of dyads and tetrads was equally irregular, so that diploid, triploid or tetraploid spores were formed.

The results are again very different from those of Vakar and it becomes evident that marked racial differences exist within both the species of *Agropyrum* used. Both these and other species require thorough examination and revision, from the systematic and cytological points of view. By trying a large number of varieties of both *Agropyrum* and *Triticum* it is possible that a combination will be found which gives an F_1 of high fertility.

140. BERG, H. M. vom 633.11:575.242:576.354.46
633.11:576.356
Zytologische Untersuchungen an der Nachkommenschaft künstlich erzeugter Weizenmutanten. (Cytological investigations on the progeny of artificially induced mutants of wheat).
Ber. dtsch. Bot. Ges. 1935 : 53 : 548-59.

Investigations of the Garnet wheat material already used by Dix in producing mutations by various treatments (Cf. "Plant Breeding Abstracts," Vol. IV, Abst. 936) shewed that 25 extreme types among the F_2 of the progeny of one treated plant all shewed the normal chromosome number $n = 21$.

It also appeared that under the climatic conditions of Schleswig-Holstein Garnet exhibited about 24 per cent heterotypic divisions with univalents whereas in its native Canada the percentage was only 5.8 per cent.

An interesting indication of a tendency to revert to a more stable condition was that it was the original strain that shewed the highest percentage of divisions containing univalents while all the mutated forms examined tend to approach the normal number in this respect.

141. SAPEHIN, A. A. 633.11 *T. durum* : 575.243:537.531
(X-ray mutations in durum wheat).
J. Bot. URSS 1935 : 20 : 3-9.

Triticum durum has been found to be very much less susceptible to the effects of X-rays than *T. vulgare* and it was thought possible that this might account for the occurrence of only a few

gene mutations, with hardly any chromosome mutations, in X-rayed material of this species left by the late L. Sapehin. To test this view ears of two pure lines of *T. durum melanopus* were X-rayed 1-2 days before flowering with fairly high doses. The germinating power of the seeds was greatly reduced and many of the plants produced were abnormal and died at an early date. The ears of the surviving plants displayed various abnormalities, certain aberrant types such as those with soft glumes and those with thread-like elongations of the tooth being particularly common. The variety of mutant types was much less than in *T. vulgare*. Irregularities of meiosis, with 1-2 univalents and dyad and triad formation, were observed in six plants. The majority were sterile and were obviously also chromosome mutants. Most of the normal F_1 plants gave a normal F_2 , though some segregated into normal and abnormal, while the abnormal F_1 plants all gave a certain proportion of abnormals in their progeny.

142. KATAYAMA, Y. 633.11 *T. monococcum*:576.356.2:537.531
On a chromosomal variant induced by X-ray treatment in *Triticum monococcum*.
 Proc. Imp. Acad., Tokyo 1935 : 11 : 110-11.

The individual described occurred in the progeny of a plant irradiated by X-rays some ten hours after flowering, i.e. at the time when fertilization was calculated to be in progress. The variant was slender, resembling a haploid plant, but taller; its fertility was only 36 per cent and its seed germinated poorly. The diploid chromosome number, $2n = 14$ was observed at meiosis; four of these chromosomes united together, however, at one end, though a closed ring was never formed; a tripartite formation with one univalent occasionally occurred. From these observations it is concluded that a small part of one end of one chromosome had become translocated with a non-homologous chromosome in the young zygote shortly after fertilization.

143. KIHARA, H. and WAKAKUWA, S. 633.11:576.356.4
(Alteration of growth, fertility, and chromosome number in the succeeding generations of the 40-chromosome dwarfs in wheat).
 Jap. J. Genet. 1935 : 11 : 102-08.

In the progeny of the pentaploid hybrid *T. polonicum* x *T. Spelta*, four types of 40-chromosome, sterile dwarfs have been found, D-2g, D-2f, D-2e and D-2d (D = spelt-genom; a, b, c, d, e, f, g = the 7 chromosomes of the spelt genom). In the progeny of the first three types in succeeding years there appeared, at first singly, later in greater numbers, fertile forms of normal habit, which proved to have 42 somatic chromosomes.

When *T. Spelta* was crossed with the dwarf forms D-2g and D-2e, $20n + 1r$ were found at meiosis in the hybrid, while $20n + 2r$ were found in the hybrid between *T. Spelta* and the fertile forms derived from the same dwarfs, shewing that the new chromosomes are not the g and e respectively of the spelt-genom. In the fertile derivatives themselves, the new chromosomes occasionally unite with one of the chromosome pairs to form a trivalent, which is not found in the hybrids *T. Spelta* x 40-chromosome dwarfs. Hence it is concluded that the new chromosomes are derived from one of the Emmer genomes (A or B), being the corresponding chromosomes to g and e respectively in the speltgenom, and are therefore designated γ and ϵ .

144. KATAYAMA, Y. 633.11:576.356.52:576.354.4
 633.11:575.129:576.354.4
Karyological comparisons of haploid plants from octoploid *Aegilotriticum* and diploid wheat.
 Jap. J. Bot. 1935 : 7 : 349-80.

From bagged spikes of *Aegilotriticum* ($2n = 56$) two haploids were obtained, one (a) with 27 chromosomes plus a small fragment and the other (b) with 28 chromosomes. Meiosis was studied in the pollen mother cells of these plants and compared with that in the F_1 of the cross *Ae. ovata* x *T. dicoccoides*, from which the fertile *Aegilotriticum* arose (see "Plant Breeding Abstracts" Vol. II, Abst. 48). The number of bivalents formed was less in the haploids than in the F_1 and the behaviour of the univalents somewhat more regular. In b they usually moved on to the equatorial plate and split at the first division, the second division presumably being omitted,

while in *a* the formation of restitution nuclei was very common, resulting in the formation of plump pollen grains and the dehiscence of the anthers, which does not occur in *b* or in the F_1 . Haploids of *Triticum monococcum* were obtained from bagged spikes and also from X-rayed spikes. Meiosis was again studied in the pollen mother cells. At diakinesis the seven chromosomes were connected end to end to form a ring or rings. The connexions disappeared before metaphase at which stage the 7 univalent chromosomes were found distributed to two poles at random. At the second division the chromosomes split and divided in the usual way and tetrads or dyads were produced. Occasionally a bivalent was observed at the first metaphase and sometimes a univalent split at the first division. Out of one thousand pollen grains examined, five were plump and the rest shrunken and empty; this observation is in agreement with the fact that 4 pollen mother cells out of 500 shewed a 0-7 distribution of chromosomes at the first metaphase, which would result in the formation of 8 dyads of grains with the complete haploid complement in 2000 grains, or 4 in 1000. The seed production on unbagged spikes, however, was less than expectation on this basis, possibly owing to shortage of pollen. From the haploid *Aegilotriticum a*, progeny were obtained with 53, 52, 49 and 49 + f chromosomes, while from the haploid *monococcum* 3 haploid and 3 diploid plants were obtained. The behaviour of these haploids is compared with others and the various haploids so far recorded in plants are tabulated and classified.

145. NAMIKAWA, S. and KAWAKAMI, J. 633.11:576.356.5:581.481
On the occurrence of the haploid, triploid and tetraploid plants in twin seedlings of common wheat.
 Proc. Imp. Acad. Tokyo 1934 : 10 : 668-71.

Many cases of twin seedlings have been observed in breeding experiments with *Triticum vulgare* and out of 29 of these examined 10 displayed differences between the pairs, both morphological and karyological. In one case one of the pairs proved to be a haploid while the other was diploid; in another case one was tetraploid and the other diploid, whilst in eight instances one triploid and the other diploid occurred. The plants and their karyotypes are illustrated.

146. VASCONCELLOS, J. DE CARVALHO E 633.11:581.162.32:575.127.2
 Estudo sumário duma hibridação natural de trigos. (**Brief study of a natural hybrid of wheat**).
 Rev. Agron. Lisboa 1934 : 22 : 27-39.

Great variation was observed in the progeny of a certain plant of *Triticum turgidum* var. *iodurum* A1. and the different types were separated to study whether they were the products of segregation. Segregation was observed for pubescence and colour of glumes and for grain colour and though the majority of plants resembled the parental variety the proportions were such as might be expected from a hybrid, the characters of the parental variety being mostly dominant. The parental plant is thus thought to have been a natural hybrid, most probably with *T. durum*. Linkage was observed in the F_2 and F_3 between black ears and pubescence. Some plants were without the waxy deposit and in explanation of this it is suggested that the second parent was *T. durum* var. *leucomelan*, which is waxless. All the homozygous plants were separated in F_3 and sown to produce an F_4 consisting entirely of homozygous families; fourteen of these are described, three of which are ascribed to *T. turgidum*, the rest to different varieties of *T. durum*.

147. KNYAGINICHEV, M. I. 633.11:581.192.1:664.641.016
(Varietal differences of wheats according to the ash content in grain and flour).
 Bull. Appl. Bot. Leningrad 1934 : Ser. 3(5) : 169-201.

The salt content of the wheats examined was found to vary very much according to the region in which they were grown. However, at all points certain differences were observed between the various groups, as follows : the grain of winter wheats had a definitely lower salt content than spring varieties of both *T. vulgare* and *T. durum*, the difference amounting on an average to 13-14 per cent. Furthermore, the varieties with vitreous grain contained more salts than the starchy winter varieties.

The salt content of the grain and the flour was not always the same : the salt content of the flour in winter wheats was lower than that of spring soft wheats by 25 per cent and lower than that of spring hard wheats by as much as 63 per cent. Again the vitreous varieties gave flour with higher salt content than the starchy ones. These differences were especially marked when dealing with the high quality flours containing only the endosperm of the grain from which the husk and aleurone have been discarded, and the reason is found in the observation that in these vitreous forms, especially *T. durum*, there is a greater relative concentration of salts in the endosperm, as compared with the outer layers of tissue, than there is in the starchy forms. This relatively high salt content in the endosperm is regarded as a valuable feature which in breeding may serve as a method of identifying the high quality lines among the segregates after hybridization. Further studies on the inheritance of this difference between the hard and soft wheats are to be undertaken.

148. Voss, J. 633.11:581.48:578.088.1
Die Unterscheidung der Weizensorten am Korn und im Laboratoriumsversuch.
(The identification of varieties of wheat by the grain and in laboratory
experimentation.)
Mitt. Biol. Reichsanst. Berl. 1935 : 51 : Pp. 54.

The importance of the identification of varieties of crop plants has been emphasized by the recent prohibition in Germany of the sale of non-pedigree or officially unapproved seed. The present pamphlet deals with methods of identifying seed by the characteristics of the grain and its coverings, by the phenol test, by germination tests and the effects of phenol on this process. Further aids in the diagnosis may be obtained by a study of the characteristics of the embryo and of the seedling and the subsequent development of the plant in the hothouse. The distinguishing marks of spring and winter wheats are discussed and the methods of raising winter wheat under hothouse conditions are mentioned. The fluorescence response of red and white eared wheats under a mercury vapour lamp offers a means of distinguishing these two types.

A review of recent literature is appended with an alphabetical list of some well-known winter and spring wheats, classified according to the criteria already described.

149. CHMELÁK, F. and ŠIMON, J. 633.11:581.9(43.7)
Návrh odrůd pro pšeničné oblasti v Československu. (Wheat varieties
proposed for the natural regions of Czechoslovakia.)
Rec. Inst. Rech. Agron. Rép. tchécosl. 1933 : 112 : Pp. 87.

Following research lasting from 1921 to 1932 it has been possible to map out the whole of Czechoslovakia into natural wheat regions based on soil and climatic conditions and the varietal adaptation of various wheats.

The individual performance of certain Czech varieties and hybrids and of Moravian, Slovakian and Bohemian wheats is recorded.

Tests with improved types were in general quite satisfactory. Both yield and quality of Slovakian and Moravian awned wheats were improved. Bohemian red grained types and the alternative wheats were outstanding in grain quality.

150. BUSTARRET, J. and CHEVALIER, R. 633.11-2.451.3-1.521.6:575(44)
Création de blés résistants à la carie. (Production of wheats resistant to
bunt.)
Sélectionneur 1934 : 3 : 166-82.

Having discussed in general resistance, the technique of artificial infection, the estimation of the extent of attack, resistant varieties and the influence of the place of origin of the bunt material (*Tilletia* sp.) and having briefly considered the findings derived from the literature on the subject, the author describes certain crosses made at the Dijon plant breeding station.

Crosses of the resistant Hussar or Martin with the susceptible types Mon Desir and Bijou and some Vilmorin strains revealed incomplete dominance of resistance. No correlation was apparent between resistance to bunt and the presence of awns. After 5 generations a number of resistant families was obtained that were also promising as regards morphological characters of the grain, yield and, in some instances, resistance to cold, yellow or black rust and baking quality. In other crosses between the resistant Baulmes and a number of susceptible Dijon hybrids resistance was not dominant, and from the very high rate of infection in F_1 , it almost seemed as though susceptibility were dominant. Baulmes is known to be greatly inferior to Hussar or Martin in resistance and probably does not carry the same factor or factors for this character. The type of bunt prevalent in France is briefly discussed and the well known method of breeding for resistance to bunt is outlined as a programme for future work.

151. RUDOF, W. [sic? RUDOLF] and JOB, M. M. 633.11-2.452-1.521.6
 Consideraciones sobre el fenómeno de la resistencia a las royas en el trigo.
 (Considerations on the phenomenon of rust-resistance in wheat.)
 Rev. Argent. Agron. B. Aires 1935 : 2(5):24-30.

A discussion of "mature plant resistance" and other forms of rust resistance, in which emphasis is laid on the importance of the influence of temperature on the degree of resistance. The susceptibility of the different rusts to temperature is in the following order: *Puccinia glumarum*, *P. triticea* and, least, *P. graminis*. This is not enough however to explain the phenomena and it is important that the question should be studied both from the genetical and physiological viewpoints.

152. CLARK, J. A. and SMITH, G. S. 633.11-2.452-1.521.6:575
 Inheritance of stem-rust reaction in wheat II.
 J. Amer. Soc. Agron. 1935 : 27 : 400-07.

A continuation of work described in an earlier paper (see "Plant Breeding Abstracts," Vol. IV, Abst. 139), with the object of determining whether strains derived from Hope and H-44 wheats have the power of transmitting the near-immune reaction to stem-rust which they derived from their emmer ancestor. Three strains C-6-1, C-6-2, and C-10-35 from the F_3 of the cross H-44 x Ceres were crossed with Marquis and the rust infection of the F_3 progeny of these latter crosses was studied. The rust infection of the F_3 progeny in the original strains was also studied and the variance in each strain, to determine whether they were homozygous. The three parental strains had all been classified as near immune in F_3 but C-10-35 proved to be resistant, lacking the dominant inhibiting factor *I* for near-immunity; all three were homozygous.

The results obtained are consistent with the suggestions put forth in the earlier paper, namely that H-44 carries the dominant inhibiting factor *I* for near-immunity and the dominant susceptibility factor *S* (*I**SS*), Marquis the recessive non-immunity factor *i* and the dominant susceptibility factor *S* (*iiSS*) and Ceres the recessive non-immunity and the recessive resistance factors (*iiSS*). The parents used in the crosses were shown to be C-6-2-1 *I**SS*, C-6-1-2- *I**SS*, and C-10-35-1 *iiSS*, and the various genotypes to be expected were recovered in approximately the expected proportions. The possibility of recovering the reaction of the parents was demonstrated. It is possible that minor modifying factors also influence the inheritance of the reaction, but this could not be definitely established.

Awnedness was found to be inherited as a single genetic factor but no significant connexion between awnedness and rust infection was found. Time of maturity was also studied and positive correlation between lateness and rust infection was found in the first cross, none in the second, and negative in the third.

153. CRÉPIN, C. 633.11:664.641.016(44)
 Valeur boulangère et amélioration des blés. (Baking value and wheat improvement.)
 Sélectionneur 1934 : 3 : 65-69.

This paper contains a re-statement of the genetic portion of the contents of the article previously reviewed (Cf. "Plant Breeding Abstracts," Vol. IV, Abst. 967).

154. **Miège, E.** 633.11:664.641.016(64)
 Contribution à l'étude de la valeur boulangère des blés. (**A contribution to the study of the baking value of wheats.**)
 Rabat 1934 : Pp. 108.

A continuation, on the same lines, of the previous study of quality in wheat and the various factors determining it (Cf. "Plant Breeding Abstracts," Vol. IV, Abst. 397). Samples numbering 1,350 were tested. Selected Moroccan wheats gave some remarkably good results in the extensimeter tests and again quality was demonstrated to be a varietal character though the influence of various modifying factors was clearly seen.

155. 633.11:664.641.016:575.11
 633.11-1.557:575.11
 633.11-1.547.2:575.11
Aamodt, O. S., Torrie, J. H. and Wilson, A.
Studies of the inheritance of and the relationships between kernel texture, grain yield, and tiller-survival in crosses between Reward and Milturum spring wheats.
 J. Amer. Soc. Agron. 1935 : 27 : 456-66.

The studies were carried out on the F_2 and F_3 generations of the cross between Reward, a hard red spring wheat with a fair yielding ability, exceptionally good baking quality and a vitreous kernel, and Milturum, a soft red spring wheat with high yielding ability, poor baking quality and a starchy kernel.

Starchy texture of the kernel was dominant in the F_1 , and in the F_2 and F_3 the distribution of the various grades of starchiness and vitreousness followed the normal frequency curve, suggesting that texture is governed by multiple factors.

There was no significant deviation among the yields of the various F_2 populations except in one, which was lower than the average. With this one exception, the average yield was not statistically different from 4.6, which is nearer that of Reward (4.2) than that of Milturum (7.0), indicating dominance of the low yield. No satisfactory genetical explanation can be offered for the inheritance of yield of grain.

The differences between the F_2 populations in mean tiller survival (number of tillers which produced mature heads) are regarded as due to soil heterogeneity. No significant differences were found in the F_3 between the parents and hybrids.

Simple correlation studies shewed no correlation between kernel texture and yield, a high positive correlation between tiller survival and yield, and a low but significant correlation between texture and tiller survival. Similarly, partial correlation studies shewed no correlation between texture and yield with tiller survival held constant, high correlation between tiller survival and yield with texture held constant, and low but significant correlation between texture and tiller survival with yield held constant.

It is pointed out that many of the above results differ from those of other workers, and this is in each case attributed to the different material and the different environmental conditions.

156. **Shibaev, P. N.** 633.11:664.641.016:578.081
 (**On the methodics of analysis of baking qualities of wheat.**)
 Proc. Cent. Sta. Pl. Breed. Genet. Saratov, 1934 : 1 : 123-50.

The different physical and chemical properties influencing the baking quality of the grain are defined and discussed, special reference being made to the importance of the quality of the gluten as opposed to its quantity. The methods of Cutler and Worzella and of Pelshenke are described. Tests of the former method were made in 1931 and 1932 at the Saratov breeding station, using however a temperature of 30-32°C. and ordinary yeast, the results being compared with the standard baking tests of the same varieties. The time factor for the vitreous varieties of *Triticum vulgare* was greater than for the starchy varieties. The time factor for *T. durum* was less, but here it was more closely correlated with the baking results of the different varieties. Only one exception to this was found, *melanopus* 69 having a high time factor but low baking quality.

The same correlation between a high time factor and high baking quality was observed in the soft spring wheats, though the correlation was much less pronounced and the exceptions much more frequent. The correlation between vitreousness and baking results was not marked, amounting to only $+0.317 \pm 0.114$ in 1931 and $+0.59 \pm 0.085$ in 1932, the correlations between the time factor and baking quality for these two years being respectively $+0.59 \pm 0.08$ and $+0.74 \pm 0.06$. In the *durum* wheats the correlation of the time factor with vitreousness was negative.

The winter wheats gave correlations between the time factor and baking quality of $+0.28 \pm 0.05$, $+0.64 \pm 0.13$ and $+0.29 \pm 0.03$ in 1930, 1931 and 1932 respectively.

The manner in which the ball of dough breaks is characteristic for certain groups of varieties.

The time factor and quality were influenced by other factors such as time of harvest, irrigation, and conditions of growth and not always to the same degree or in the same direction. Any figures obtained by this method should therefore always be compared with those for a known standard variety grown under similar conditions.

The general conclusion is that the method gives fairly reliable correlations with baking quality, loaf volume and porosity being closely correlated with the time factor, whereas the absorptive capacity and vitreousness give low correlations. The method provides a rough classification of the quality of the varieties and as such is useful in breeding, for selecting the most outstanding lines. The finer distinctions can be estimated only by some more accurate method.

157. 633.11.00.14(47)

(Summary of varietal experiments with spring wheat in 1933.)

Lenin. Acad. Agric. Sci., Inst. Pl. Ind., Var. Testing Serv. 1934: Part I:

Pp. 68.

A report of the varietal tests carried out in different regions of the U.S.S.R. with a number of new and promising varieties of spring wheat, which are enumerated. Information is given concerning the climatic nature of each region and the varieties which prospered most in each.

OATS 633.13

158. EMME, E. K. 633.13:575.127.2:575.11

(Certain laws governing the inheritance of morphological characters in interspecific oat hybrids.)

Bull. Appl. Bot. Leningrad 1934: Ser.A (13): 5-14.

The author starts by giving a list of the known interspecific and intervarietal hybrids in oats, grouped according to chromosome number, including some of the author's own crosses. An examination of these hybrids discloses certain common features in the behaviour of the characters distinguishing the different groups of species. For example the characters of the 42 chromosome species are dominant in crosses with the 28 and 14 chromosome groups and those of the 28 chromosome group are similarly dominant to those of the 14 chromosome species. This behaviour is regarded as evidence for the true autopolyploid origin of the 28 and 42 chromosome groups, with a certain amount of subsequent differentiation of the chromosomes within the different genomes. This differentiation would explain why certain characters are not subject to such quantitative influence, but are inherited independently of chromosome number.

Another general phenomenon is that the end stage of certain structural characters is identical in a number of species and hybrids which are not in the least related one with another. Thus the type of rachilla of the first spikelet characteristic of all the cultivated 42 chromosome oats of the cycle *A. fatua* is also found in the F_1 of the 28 chromosome ssp. *abyssinica* x ssp. *macrantha* and in all other combinations of *abyssinica* with the 42 chromosome cultivated forms; in the F_1 of the 28 chromosome ssp. *barbata* x ssp. *macrantha* and *sativa*; in the F_1 of ssp. *macrantha* and other 42 chromosome cultivated forms x ssp. *fatua* and ssp. *Ludoviciana* (both the latter having also 42 chromosomes), and in certain F_1 - F_4 hybrids of the combination proles *nuda chinensis* x ssp. *fatua*, neither of which parents have this type of rachilla. It is possible that the same explanation is applicable, in the case of the combinations of different chromosome number, namely the autopolyploid hypothesis and the absence of one set of the necessary factors in the wild types of the 42 chromosome group, and its consequent recessiveness to the cultivated

forms. It is also possible however that the process of formation of the cultivated type in these different cases is different, though the end product is apparently the same.

The third general phenomenon referred to is the production of awnless forms in the F_1 of two 100 per cent awned species, as in the F_1 of ssp. *abyssinica* var. *glaberrima* x ssp. *macrantha* subvar. *iranica*, of which five series, involving over a hundred plants, were grown and all were entirely awnless. It is possible that this is a case of complementary factors, but in view of the fact that all other pentaploid combinations, including those of ssp. *abyssinica*, produced awned forms, it is possible that in the particular 42 chromosome parent used one of the factors for awnless was either absent or present in too small a quantity to produce awnlessness. The action of modifying factors is not excluded.

The fourth point is the dominance of the cultivated over the wild characters in crosses between wild and cultivated forms within the cycle *A. fatua* of the hexaploid group, whereas in such crosses within the 14 and 28 chromosome groups the wild characters are dominant. In the hexaploid crosses most of the characters distinguishing the cultivated from the wild type are monohybrid, or at the most dihybrid, which is in distinct contradiction to the above assumption of their autopolyploid origin. In such cases the monohybrid inheritance could only be explained by assuming that the three multiple factors segregate as a block but much further investigation is required before these questions can be finally settled.

The possible interrelationships of the species are discussed.

159. NISHIYAMA, I. 633.13:576.356.4:575.11
The genetics and cytology of certain cereals. VII. Genetical significance of the c-chromosome in hexaploid *Avena* species.
 Jap. J. Bot. 1935 : 7 : 453-69.

With a view to studying the role of the c-chromosome in *A. fatua* and *A. sterilis*, these species were crossed with heterozygous fatuoids from *A. sativa* (having $20 \text{ II} + \text{c}$ at meiosis), producing F_1 plants with 41 or 42 chromosomes. In the F_2 from the former 40-chromosome plants were obtained, lacking both c-chromosomes, as well as 41 and 42 and certain aberrant types. The progeny lacking both c-chromosomes shewed the same irregular meiosis as homozygous fatuoids in *A. sativa* and *A. byzantina*, pairing being much reduced, or completely wanting, the number of bivalents varying from 0-10. In the 41-chromosome types $20 \text{ II} + 1 \text{ I}$ were usually found, though in all types a certain amount of multivalent formation was found.

The inheritance of the grain character complex was also studied in the F_1 and F_2 . In the progeny of the *sterilis* cross it was found that the 41-chromosome types resembled *A. sterilis* in this respect, while the 42-chromosome plants were more like the heterozygous fatuoid parent or *A. sativa* and hence it is concluded that the factor or factors for the grain characters are carried on the c-chromosome in *A. sterilis* and are partially recessive to those of *A. sativa*. The 40-chromosome segregates obtained in the F_2 were fatuoid in character. In the case of the *fatua* cross the various types could not be easily distinguished as the *fatua* and fatuoid complexes are similar.

Observations on the inheritance of hairs on the back of the grain indicate that the c-chromosome from *A. fatua* or *A. sativa* produces at least a few hairs on the back of both grains.

The author's results are discussed in relation to other work on fatuoids, and it is concluded that the function of the c-chromosome in these two species corresponds to that of the c-chromosome in *A. sativa* and *A. byzantina*, i.e. it controls their specific grain characters, their chromosome pairing at meiosis and causes a few hairs on the back of the grain.

160. ANDREEVA, N. V. 633.13-1.524.4(47)
 (The local oats of White Russia.) 633.13-2.452-1.521.6(47)
 Semenovodstvo (Seed Growing) 1935 : No. 4 : 22-23.

The production of varieties capable of resisting the severe rust attacks of White Russia is a problem of the first magnitude. Extensive tests have been made at the Minsk station with pure lines isolated from the local wheats. Four of these are mentioned as being superior to the best selected variety, A 315, both in yield and rust resistance and a strong recommendation is made that these local wheats should be used in breeding.

161. ANTROPOV, V. 633.14:575(47)
(The requirements that must be fulfilled by modern varieties of rye for grain purposes in the U.S.S.R.)
 Bull. Appl. Bot. Leningrad 1934 : Ser. A (13) : 35-43.

The author discusses a number of factors which exercise an influence on the yield and quality of grain and which should therefore be taken into account in breeding rye.

Size of grain is the first important factor, though there are limits beyond which selection for grain size is not profitable ; the grain should be not only large but well filled. A long ear is not desirable as it is generally associated with long straw ; nor is excessive density desirable, although both these characters make for high yield per ear ; a moderate degree of density is therefore aimed at, and this is usually combined with a short strong straw. An upright ear is to be avoided because of fungal attack. Three-grained spikelets are not to be encouraged as the third grain is usually smaller and makes for an uneven product. Branched ears have similarly not yet been shewn to have any advantage. Thick husk has an adverse influence on yield of grain and is also to be avoided.

Biological features are of primary importance for certain regions : drought resistance and cold resistance in dry zones, the capacity to retain viability for long periods under a snow covering for areas with heavy snow ; tolerance of excessive moisture may also be of great significance in humid areas.

One of the chief improvements at present required is in the direction of adaptation for mechanical harvesting. Here the deciding features are standing capacity, height of plant, tillering, uniformity in height, and non-shattering : the strength of the root system has a direct influence on standing capacity, and to attain uniformity in height and in maturity it is desirable to avoid excessive tillering.

Hereditary differences exist between varieties in respect of their capacity to make use of favourable growth conditions and it is essential that only those strains possessed of this capacity to the maximum degree should be selected.

The various characters considered are shewn in tabular form, with remarks indicating the effect of each character on the plant and its behaviour.

162. KRASNIUK, A. A. 633.14:575.14
(Inbreeding in rye and its utilization in practical plant-breeding.)
 Socialistic Grain Farming, Saratov 1935 : No. 2 : 118-24.

Inbreeding in rye produces the usual quantity of recessive forms, both desirable and undesirable, and recently certain progenies have been obtained in which not the least trace of depression is detectable and which in fact excel the parental population in many valuable respects. The results depend upon the nature of the initial material and upon a number of other factors, but the production of improved strains by direct inbreeding constitutes a great advance on the method of diallel crossing (see " Plant Breeding Abstracts," Vol. V, Abst. 684) in respect of the saving of time.

A large proportion of the undesirable forms emerge in the first and second inbred generations and selection can be started at this stage. Inbreeding is continued from generation to generation until homozygosity is reached. The best lines are then sown and compared with the standard and plants are isolated, either individually or in groups, according to the degree of homozygosity. Group isolation ensures a better set of seed. Only this isolated seed is used for sowing. When really good lines are obtained they are subjected to spatial isolation and final comparative tests. Such promising lines in 1934 at the Saratov station gave excellent yields, e.g. one line in the sixth inbred generation gave 46 per cent more yield than the standard local Eliseevskaja rye and the average grain weights were also higher.

163.

SAX, K.

633.14:576.354.46

635.651:576.354.46

Variation in chiasma frequencies in *Secale*, *Vicia* and *Tradescantia*.

Cytologia, Tokyo 1935 : 6 : 289-93.

Darlington (see "Plant Breeding Abstracts," Vol. IV, Abst. 405) found a higher chiasma frequency in *Secale cereale* (average 2.4 per bivalent) than the author (average 1.9 per bivalent). Different workers have found different chiasma frequencies in *Vicia Faba*, while in *Tradescantia* different species have different average frequencies. In the last genus, chiasma frequency was reduced from 2.1 to 0.2 after six days at 33°C. It seems probable that both environmental and varietal factors can influence chiasma frequency.

No correlation, such as Darlington (*loc. cit.*) found in $n = 8$ *Secale*, was found between chiasma frequency in the long "M" chromosome and in the short chromosomes of *Vicia Faba*.

164.

KRASNIUK, A. A. and NASARYEVA, Z. D.

633.14:578.088.1:581.48:575.1

(Laboratory method for identification of genuine varieties of winter rye).

Socialistic Grain Farming, Saratov 1935 : No. 3 : 101-09.

A technique was worked out for distinguishing between varieties by phenol coloration. The best concentration was 0.5 per cent, applied for 1-2 hours, the final observation being made at the end of 10 hours.

The characteristic reactions of a number of varieties and hybrids are given. No significant differences were observed between mixed impure populations and rigidly selected populations of the same varieties. Inbred populations showed signs of segregation for the degree of coloration of the grain and further studies are to be made on its mode of inheritance.

MAIZE 633.15

165.

633.15(47)

633.17(47)

(Results of variety tests with maize, millet and sorghum in 1933.)

Lenin. Acad. Agric. Sci., Inst. Pl. Ind., Variety Testing Section 1935 : Pp. 96.

An account of the yields of the different varieties in all the main areas of the Soviet Union.

166.

SINGELTON, W. R.

633.15:575

Early researches in maize genetics.

J. Hered. 1935 : 26 : 49-59, 121-26.

An account of early studies on inheritance in maize.

167.

YASUI, K.

633.15:575.11

(Genetical studies in *Zea mays* L.)

Bot. Mag. Tokyo 1935 : 49 : 234-46.

Anther ear 2 (an_2) appeared among the normal stem plants of an F_2 progeny segregating 9 normal stem green : 3 normal stem yellow : 3 dwarf green : 1 dwarf yellow ($dd\ pg\ pg$). The an_2 plants had short internodes, the long styles folded inside the bracts, and male flowers on the female inflorescence. The segregation is believed to be 3 : 1. Anther ear 3 (an_3) appeared in brown pericarp progeny segregating 3 : 1 for the latter character. The progeny of a selfed plant of "Odaishi-kibi" segregated into 3 normals : 1 twisted dwarf. From some crosses of purple "Odaishi-kibi" x colourless endosperm, one-quarter of the progeny had variegated leaves, which is ascribed to a single factor vr ; in such families were also found yellow seedlings, later turning green, and with poor root development (rd). The segregation was either 15 : 1 or 3 : 1. The grains on F_1 plants from a cross between purple aleurone, yellow endosperm, flint and white pop segregated into approximately 12 blue : 3 yellow : 1 white, and popped on ripening. Studies on length of ear showed that the parents differed by at least 2 factors for this character. Curved stems (cu) appeared in F_4 , segregating 3 normal : 1 curved.

In conclusion, a list of 33 characters studied by the author is given, some new, and some already known. It is suggested that the environment exerts an influence on the mutation of genes but the effects are so small that normally they appear statistically as "errors." The extensive occurrence of some mutants, e.g. dwarf, may possibly be ascribed to deletion of genes. In the experiments, sulphuric acid paper was used to cover the male inflorescences and both sulphuric acid paper and paraffin paper was used for ♀ ears, to allow observation of the styles.

168. BRINK, R. A. 633.15:575.113:575.116.1

Heritable characters in maize. XLIX. Pale midrib.

J. Hered. 1935 : 26 : 249-51.

A new gene in maize, pale midrib (*pm*) causes a reduction in chlorophyll along the midrib of the leaf and in the leaf sheath. It is completely recessive to normal and is readily distinguished from it. The reduction in viability and fertility is no greater than in many other factors which have been worked on by maize geneticists.

The *pm* gene is located in the *A₁-Rg₁* linkage group, on chromosome 3, and shews 8 per cent crossing-over with *Rg₁* and 33 per cent with *na* (nana), the order of the genes being *na-pm-Rg₁*.

169. BRINK, R. A. 633.15:575.116

Linkage relations in the *A-Rg* group in maize.

Amer. Nat. 1935 : 69 : 283-85.

The finding of the dominant ragged (*Rg₁*) character in maize a few years ago has facilitated the mapping of the genes in group 3, both in determining what genes belong to the group and in finding the relative positions of those that are known to belong to it. The present paper reports the results of five experiments bearing on the latter problem ; the linkage relationships of the factors *a₁na lg₂ ba₁ ts₄ Rg₁* and *d₁* are reported.

170. SMITH, G. M. 633.15:575.12(73)

Hybrid sweet corn.

Canning Age 1935 : 16 : 243-45.

An article for canners and growers on the development of inbreeding as a method of improvement, the connotation of the term hybrid as applied to maize, types of hybrids including the double-cross, the three-way cross and the top cross, and their advantages and disadvantages from the commercial standpoint.

171. LINDSTROM, E. W. 633.15:575.125:575.11

Genetic experiments on hybrid vigor in maize.

Amer. Nat. 1935 : 69 : 311-22.

The distribution of ear weight was studied in the *F₁* and *F₂* populations from two crosses between inbred lines of maize, shewing pronounced heterosis in the *F₁*. If heterosis is to be explained in terms of dominance of size genes, a pronounced skew distribution might be expected in the *F₂*; this was not found in the present experiment, only a small amount of skewness, negative in sign being found. The distribution of length and diameter of ears and number of rows of grains was also studied, negative skewness being found in the first two cases and positive in the last.

Studies on the correlations between these three characters and weight of ear shewed that length and diameter had a marked positive influence on weight, while number of rows had a slight negative effect.

It is considered that these results, regarded as a whole, are in line with the theory that hybrid vigour is due to dominant size genes, the small amount of skewness in the weight distribution being attributed to a balance of genes, some of which exhibit dominance for large size and some for small size.

To test Ashby's hypothesis that hybrid vigour is simply due to increased embryo size and not to increased growth rate (see "Plant Breeding Abstracts," Vol. III, Abst. 148), six lots of F_1 progenies were decapitated above the growing point, thus greatly reducing their "capital." Although the plants so treated were delayed somewhat in silking and did not attain the dry weight of untreated F_1 controls, they exceeded in dry weight the pure lines from which their parents were derived, and so it was concluded that they must have had greater growth rates than their parents, and hence that the dominant size genes concerned in heterosis produce a higher rate of growth in the hybrid than is found in the parental inbred stocks.

172. JENKINS, M. T. 633.15:575.125:578.081
Co-operative uniform comparison of Krug top crosses, 1934.
 Bur. Pl. Ind. Div. Cereal Crops and Diseases : U.S. Dep. Agric. Lib. 1935 :
 Pp. 10.

Tests were made for the second season, at 5 different locations, of 23 top crosses and the open pollinated variety Krug with a view to determining the crossing value of the pure lines concerned. Statistical analysis of the results shewed that there were 5 pure lines whose top crosses yielded significantly more than the average, while 2 lines and the open pollinated variety were below it. Analysis of variance shewed that season had rather more effect on the placing of the lines than had location.

173. MANGELSDORF, P. C. and REEVES, R. G. 633.15:575.127.5:576.354.4
A trigeneric hybrid of *Zea Tripsacum* and *Euchlaena*. All of the chromosomes of maize and its two nearest relatives combined in a single plant.
 J. Hered. 1935 : 26 : 129-40.

The hybrid *Zea x Tripsacum dactyloides* produces unreduced gametes with 10 *Zea* + 18 *Tripsacum* chromosomes (Cf. "Plant Breeding Abstracts," Vol. II, Abst. 428, and Vol. III, Abst. 415). Pollination with *Euchlaena mexicana* pollen resulted in the production of 12 seeds from 208 florets. The trigeneric hybrid had 38 somatic chromosomes, presumably 10 *Zea* + 10 *Euchlaena* + 18 *Tripsacum*, and thus is trigenomic. Since in the *Zea x Tripsacum* hybrid there is little or no pairing, the formation of 10 + 18 at meiosis in the trigeneric hybrid was not unexpected. The chromosomes of the bivalents separate and move to the poles in a regular manner, while the univalents go to one pole or the other at random. All the chromosomes are usually included in the daughter nuclei, microcytes and micronuclei being rare. Comparison with meiosis in (*Zea x Tripsacum*) \times *Zea* and (*Zea x Tripsacum*) \times *Tripsacum* hybrids shews that the 10 bivalents are made up of *Zea x Euchlaena* chromosomes, the 18 univalents comprising the *Tripsacum* genom.

The hybrid is completely male sterile, and only one seed was produced by some 400 florets pollinated with *Zea*, *Euchlaena*, or *Tripsacum* pollen. The hybrid exhibits, in almost every case, any character which is common to two parents and since most of the characters of *Euchlaena* are possessed by either *Zea* or *Tripsacum*, the hybrid resembles *Euchlaena* in a great many respects.

It is suggested tentatively that by reversion, the trigeneric hybrid might bear some resemblance to the progenitor of the American *Tripsaceae* (Cf. "Plant Breeding Abstracts," Vol. V, Abst. 1005), since were it fertile, it would be capable of survival in nature, and would be at the same time at least more promising material for domestication than *Euchlaena*. Other trigenomic hybrids are discussed.

174. KRUG, C. A. 633.15:575.14
Efeitos da primeira autofecundação em tres variedades de milho. (Effects of the first self-fertilization in three varieties of maize.)
 Bol. Tech. Inst. Agron. São Paulo 1935 : No. 19 : Pp. 19.

Self-pollinations were made of two varieties of flint corn, Crystal and Amarello, and one of dent, Amparo, in 1932/1933, about 3,100 plants being self-pollinated and grains of the 1,812 soundest and healthiest cobs produced sown in 1933. Among the resulting plants various anomalies appeared and some twenty of them are described and elaborately illustrated. These

included premature germination, brittle endosperm, varying degrees of yellow owing to incomplete dominance and segregation of the factors for endosperm colour, starchy grains in the progeny of flint varieties, and a variety of different aleurone colours; various chlorophyll deficiencies, anomalies of leaf structure, dwarf plants, branched stems (regarded as a regression to the ancestral type), and branches ears; and finally various sexual anomalies, including bisexual ears, male plants with two tassels, one in place of the cob, or with only one tassel and no cob, and the reverse phenomenon of female plants with two or more cobs, or with a tassel modified into a female inflorescence with spikelets, of the type known as "tassel seed." Hybrids of commercial value are to be produced from selfed lines freed from these recessive defective genes.

175. COLLINS, G. N. 633.15:576.16

La filogenia del maiz. (**The phylogeny of maize.**)

Rev. Argent. Agron. B. Aires 1935 : 2 (5) : 1-13.

Translation into Spanish of the article reviewed in "Plant Breeding Abstracts," Vol. I, Abst. 356.

176. 633.15:576.16(72)
635.67:576.16(72)

Science News. Items.

Science 1935 : 81 : p.9.

In the collection of prehistoric maize examined by Dr. A. T. Erwin of the Iowa Agricultural Experiment Station only one undoubted example of true sweet corn was found and in Mexico too he found only one specimen in cultivation by the natives. Sweet maize, first propagated by the white man, appears to be an offshoot of field maize, the difference in flavour having escaped the notice of the Indian cultivators.

The maize grown in ancient times by the Red Indians had blue, red and yellow grains.

177. KACHIDZE, N. T. 633.15:576.356.2(016)
(**Methods of cytological analysis in studying the genetics of corn.**)
Bull. Appl. Bot. Leningrad 1934 : Ser.2(6) : 173-84.

The American work on the cytology of maize in its bearing on genetical phenomena is reviewed, including the identification of linkage groups in the chromosome, segmental interchange leading to ring formation and semi-sterility, the localization of certain genes by chromosome deletion after X-ray treatment and the conjugation of non-homologous sections of the chromosome.

178. RANDOLPH, L. F. 633.15:576.356.5
633.15:575.1:576.354
Cytogenetics of tetraploid maize.
J. Agric. Res. 1935 : 50 : 591-605.

Tetraploid maize plants were obtained by heat treatment of developing ears. In general appearance the tetraploids resemble their diploid sibs, but shew enlargement in the diameter of the stalks, the width of the leaves, the tassel, pollen, ears and kernels, and in the stomata and epidermal cells. The kernels were about 50 per cent heavier than those of diploid plants, partly due to their being less crowded on the ear owing to a reduction of 5-20 per cent in fertility in the tetraploids. The pollen of tetraploids contains about the same proportion of aborted grains as pollen of diploids. Tetraploids breed fairly true for chromosome number.

A high degree of sterility was found in the crosses between the two types, fertility as measured by the proportion of viable to aborted and defective seed being less than 0.5 per cent in the cross $2n \times 4n$ and about 5 per cent in the reciprocal cross. In the former cross only about 10 per cent of the well-filled and very few of the aborted grains germinated, while in the latter cross nearly all the well-filled and a large number of aborted grains produced viable seedlings.

In isolated plots planted with alternate rows of $2n$ and $4n$ plants, studies were made on cross-pollination, both with open-pollination, and with hand-pollination with a mixture of the two types of pollen. In each case the amount of hybrid seed was much greater on the tetraploid than on the diploid, shewing that the $2n$ pollen does not compete favourably with n pollen either on $4n$ or $2n$ styles. The proportion of hybrid seed, however, was never very large, and since little of it is viable and the triploid plants which it produces are very sterile, it is considered that tetraploid maize can be maintained under natural field conditions without hybridizing materially with diploid stocks.

No satisfactory explanation can be given for the incompatibility found between diploid and tetraploid maize.

At the first metaphase of meiosis in tetraploids the usual condition was 7-9 quadrivalents, the rest with bivalents,* trivalents and univalents being rare. Anaphase figures were usually regular and in the separation of quadrivalents sometimes adjacent and sometimes alternate chromosomes passed to the same pole. Separation however was not always regular and pollen grains and selfed seedlings with irregular chromosome numbers were found. In the seedlings there was no definite correlation between atypical chromosome number and vigour of the plant.

179.

633.15:581.143.7.036:575.11.061.6

SMITH, O. F.

633.15-2.42-1.521.6

The influence of low temperature on seedling development in two inbred lines of corn.

J. Amer. Soc. Agron. 1935 : 27 : 467-79.

The inbred line RYD₄ develops normally and produces chlorophyll at 24°C. and at 17°C., while line GG₂₆ develops chlorophyll at 24°C., but not at 17°C. It was found that carotin formation followed the same course as chlorophyll formation but xanthophyll was always produced. The F₁ progeny of the cross between the two lines was all green at the lower temperature, while in the F₂, provided the relatively small number of intermediate plants were grouped either as virescent or as green, a close approximation to the ratio 3 greens : 1 virescent was obtained.

Relative to the amount of development, the line GG₂₆ used up its endosperm reserves more rapidly than RYD₄ at both the higher and the lower temperatures. The dry weight of top growth produced by seedlings of the two lines was essentially the same at both temperatures but when grown to the third leaf stage at 24°C. and then transferred to 17°C., RYD₄ put on more top growth than GG₂₆.

At soil temperatures of 16°C., GG₂₆ was very susceptible to seedling blight, *Gibberella saubinetii* (Mont.) Sacc., while RYD₄ was resistant. The F₁ shewed roughly the same resistance as RYD₄, though seedlings from the cross RYD₄ x GG₂₆ were more resistant than those from the reciprocal cross. The difference is possibly due to the slower maturing of seeds on GG₂₆ than on RYD₄.

180.

KIESSELBACH, T. A., and WEIHING, R. M.

633.15:581.43:575.125

The comparative root development of selfed lines of corn and their F₁ and F₂ hybrids.

J. Amer. Soc. Agron. 1935 : 27 : 538-41.

The root development of two pairs of pure lines of dent corn and the corresponding F₁ and F₂ hybrids were studied. Well marked increases due to heterosis were found in the F₁ in root penetration, main root length, root diameter, and root spread. The F₂ plants were intermediate between the parents and the F₁ in these respects.

A decrease in the number of branches in the hybrids is attributed to increase in cell size.

* Stated as 3-1 by the author, probably in error for 6-2.

181. JONES, D. F. 633.15:581.48:575.113.061.63
A multiple mosaic in maize.
 J. Hered. 1935 : 26: 191-92.

A yellow sweet corn with the aleurone colour formula $A C r p r i$ was pollinated by a white pop corn having the aleurone composition $A C R P r I$. The resulting seeds should all be white but 1 in 29 shewed patches of purple aleurone, owing to loss of the dominant I gene inhibiting colour. In one seed among 3,448 a triple mosaic was found in which two patches of purple enclosed a patch of red, while in the centre appeared a small colourless patch. The purple arose as before, the red by loss of $P r$ and the colourless either by further loss of R or by recovery of I , the starchy endosperm of the entire seed shewed that no other male parent was concerned. From evidence presented elsewhere, these mosaics are more probably due to deletions than to non-disjunction.

182. DEKAPRELOVIČ, L. L. 633.15-1.524.2:576.16(75.8)
(From the history of the introduction and distribution of maize in Georgia.)
 Bull. Appl. Bot. Leningrad 1934 : Ser. A (13) : 45-50.

The introduction of maize and its gradual distribution is traced, with descriptions of a large number of the ecotypes now existing. A medley of forms has resulted since the introduction of the dent types, which have hybridized with the ones introduced originally. Natural selection has led to the evolution of a number of forms adapted to high altitudes.

183. BIGGAR, H. H. 633.15-2.111:575
Beating early frost with cold-resistant corn. Interesting experiments give hope for solution of important problem.
 Fuirow 1934 : 39 : pages 4, 11 and 12.

A popular account of the work of J. R. Holbert on cold resistance in maize. It has been shewn that this depends on both soil conditions and the constitution of the plant, and that cold-resistant forms produce considerably higher yields.

184. RHOADES, V. H. 633.15-2.452-1.521.6:575.116
The location of a gene for disease resistance in maize.
 Proc. Nat. Acad. Sci. Wash. 1935 : 21 : 243-46.

The inheritance of resistance to physiological forms 1 and 3 of rust of corn *Puccinia Sorghi* Schw. is dependent in each case on a single Mendelian factor. To determine the chromosomal location of the factor for resistance to form 3, pollen from a plant homozygous for the dominant factor for resistance was X-rayed and used to pollinate susceptible plants. In the progeny a number of susceptible plants were obtained, and certain of these on cytological analysis proved to be deficient in part of the short arm of the tenth (smallest) chromosome, indicating that the factor in question was located there. This conclusion was verified genetically by means of trisomic ratios. All the eight primary trisomics so far obtained were crossed with resistant plants and the $F_1 2n + 1$ plants back-crossed on susceptible plants; divergence from the 1 : 1 ratio was only obtained in the case of plants trisomic for chromosome 10. While linkage studies have shewn that the factor is not located on chromosome 4, the investigations are as yet unfinished in the case of chromosome 1.

BARLEY 633.16

185. AAMODT, O. S. and JOHNSTON, W. H. 633.16 Peatland (71.23)
Peatland. A malting barley for the gray wooded soil areas of Alberta.
 Circ. Coll. Agric. Alberta 1935 : No. 20 : Pp. 18.

A description is given of the agronomic characters of this six-rowed, rough-awned variety, which has a stiff straw and produces a good yield of grain with excellent malting quality.

186. HARLAN, H. V. and MARTINI, M. L. 633.16:581.162.5
The lateral flowers of two-rowed barley. Varying levels of fertility possibly associated with plant vigor.
 J. Hered. 1935 : 26 : 109-13.

About 11 per cent of 408 strains of two-rowed barley (other than *H. deficiens*) exhibited a certain amount of fertility in the lateral flowers under conditions favourable to the expression of fertility. Among the strains various levels of fertility could be distinguished in the flowers, and often in the vigour of the plant growth.

MILLETS AND SORGHUMS 633.17

187. TU, C. and LI, H. W. 633.17-2.451.2-1.521.6:575.42(51)
Breeding millet resistant to smut in North China.
 Phytopathology 1935 : 25 : 648-49.

Seeds of selections from fields and from farmers' varieties were dusted with spores of kernel smut *Ustilago crameri* and grown in rows. Great variation in the reaction to smut was observed, ranging from immunity to 87 per cent infection. Of the 1,430 selections grown, 192 remained free from smut and many of these possess desirable agronomic characters.

RICE 633.18

188. CHIAPPELLI, R. 633.18:575.42
La selezione del riso ed il controllo delle sementi. (Rice selection and seed control).
 G. Risicolt. 1935 : 25 : 145-47.

Practical notes on the methods of mass selection for the production of good seed.

189. MORINAGA, T. and FUKUSHIMA, E. 633.18:576.354.4:576.356.5
Cyto-genetical studies on *Oryza sativa* L. II. Spontaneous autotriploid mutants in *Oryza sativa* L.
 Jap. J. Bot. 1935 : 7 : 207-25.

Some 150 triploid individuals, distinguished by their greater vigour and their sterility were found in fields of rice.

At diakinesis in the pollen mother cells 12 configurations, presumably trivalents, were seen though more than 12 were sometimes found, indicating that lower associations had been formed. At metaphase I a somewhat irregular plate was formed and at anaphase the trivalents disjoined 2 to 1, while occasionally univalents were observed to lag and divide.

The second division was more regular in appearance, though certain irregularities in spindle formation were noticed, and usually tetrads with four cells were produced ; few of these, however, developed into normal pollen grains, indicating that pollen with about 18 chromosomes is not viable.

In the ovules, meiosis appeared to follow a similar course, though observation was difficult. Embryo sac formation proceeded quite regularly and the usual egg cell, synergids, fusion nuclei and antipodal cells were produced though the latter usually went through supernumerary divisions. A number of abnormal sacs were also produced, and in a few cases the megaspore degenerated without further development. Very rarely the formation of an embryo or of endosperm was observed, which may or may not have been by fertilization. There was a strong tendency for ovaries to develop parthenocarpically.

The mode of origin of these autotriploids is unknown, but may be due to the fusion of haploid and diploid gametes, or to the entrance of double sets of male nuclei into the embryo sac.

190.

KONDŌ, M. and ISSHIKI, S.

633.18:581.481

Vorkommen von abnormen Reiskörnern die entweder keimlos sind oder zwei Keime besitzen. (**The occurrence of abnormal rice grains possessing either no embryos or two.**)

Ber. Ōhara Inst. 1935 : 6 : 515-24.

Previous literature on the absence of embryo in various Gramineae is enumerated.

In rice the differences between grains devoid of embryo and normal grains lie in the smaller size of the defective grains in which the space for the embryo is filled instead with endosperm tissue. The frequency of occurrence of this anomaly in rice was about 0.01-0.02 per cent.

Experiments with 4 ears of rice (3 of the Omachi and one of the Shinriki variety) showed that the defect was not heritable but was due merely to some chance disturbance at fertilization or at an early stage in the ontogeny of the embryo.

From the findings of other workers it is concluded that in grasses and conifers double and very occasionally even triple embryos are found.

The characteristics of rice grains with 2 embryos are described. Germination was delayed by 1-2 days and the embryos were very weak and easily died off. Of the young plants from such embryos some developed, though not so well as the controls; the others died. In plants from grain with double embryos the time of emergence of the panicle, of full maturity and the yield were the same as for the controls.

In rice the frequency of double embryos is .003 per cent. The anomaly is due merely to the union of two ovaries in the same flower.

ROOTS AND TUBERS 633.4

191. SAILLARD, É.

633.41:575.127.2:633.63

Réunion de la Commission des Grains de Betteraves à sucre du Ministère de l'Agriculture. . . . V. Croisement entre betteraves sucrières et betteraves sauvages. (**Meeting of the Committee of the Ministry of Agriculture on sugar beet seed. . . . V. Crossing sugar beets and wild beets.**)

C.R. Acad. Agric. Fr. 1935 : 21 : 753-65.

Among the investigations supported by the Committee is the improvement of the sugar content in sugar beet by hybridization with wild beets. Wild beets from the French coasts have been found, containing 18 per cent and 20 per cent of sugar; while some from the Baltic shores contained 22 per cent.

From the sugar beet crosses made so far, it seems that the wild beets from the Atlantic coast give the best results.

192.

633.42:575.127.2:576.312.32:576.354.4

U., N.

635.34:575.129:633.42

Genome-analysis in *Brassica* with special reference to the experimental formation of *B. napus* and peculiar mode of fertilization.

Jap. J. Bot. 1935: 7 : 389-452.

The species studied were *B. nigra* Koch ($n = 8$), *B. oleracea* L. ($n = 9$), *B. campestris* L. ($n = 10$), *B. carinata* Braun ($n = 17$), *B. juncea* Coss ($n = 18$) and *B. napus* L. ($n = 19$). In all, seven interspecific crosses were obtained and varying degrees of incompatibility were observed. Usually the best results were obtained when the species with the higher number of chromosomes was used as female parent. In some cases purely matroclinous offspring were obtained.

From the cross *B. campestris* x *B. oleracea*, four F_1 plants were obtained, COF₁-I, intermediate, closely resembling *B. napus* in appearance, rather sterile, and having 19 somatic chromosomes, and producing (0-8)_{II} + (19-3)_I at meiosis, COF₁-II, with 28 chromosomes, more fertile, and producing (0-5)_{III} + (9-4)_{II} + (10-5)_I, COF₁-III, also more fertile with 29 chromosomes, producing 10_{II} + 9_I, and COF₁-IV, with 38 chromosomes, almost fully fertile, and producing 19_{II} at meiosis. COF₁ is considered to be an experimentally produced *B. napus*, being an amphidiploid with reduplicated chromosome sets of *B. campestris* and *B. oleracea* (*aacc*), while COF₁-II and COF₁-III are triploids with reduplicated sets of *B. oleracea* and *B. campestris* respectively (*acc* and *aac*), trivalent formation in COF₁-II being due to a slight affinity between *B. oleracea* (*c*) and *B. campestris* (*a*) chromosome sets. The results of the crosses *B. napus* x

B. oleracea and *B. napus* x *B. campestris* supported these conclusions, meiosis in the F_1 of the former resembling that in COF_{1-II} and in the latter resembling COF_{1-III} , as is to be expected if the genom of *B. napus* is that indicated. COF_{1-I} , which corresponds to a haploid *B. napus*, gave in the F_2 38-chromosome types with 19 bivalents at meiosis, indicating another method for the formation of *B. napus*.

The F_1 's of the cross *B. carinata* x *B. oleracea* were very sterile, closely resembled the female parent, had 26 chromosomes and gave $9_{II} + 8_I$ at meiosis except $CaOF_{1-II}$, which was completely sterile, had 35 chromosomes and produced $(9-5)_{III} + (0-4)_{II} + (8-12)_I$, having a reduplicated *oleracea* set. The F_1 's from *B. carinata* x *B. nigra* again resembled *carinata* and were highly sterile; they produced $8_{II} + 9_I$. These results suggest that the genom of *B. carinata* is a combination of those of *B. nigra* (b) and *B. oleracea* (c), a conclusion which was partly confirmed by the observation of $(0-6)_{III} + (9-3)_{II} + (18-12)_I$ in the single, fairly fertile F_1 plant produced from the cross *B. napus* x *B. carinata*. From the cross *B. juncea* x *B. carinata*, intermediate, partially fertile F_1 progeny with 35 chromosomes were obtained, shewing at meiosis $(8-16)_{II} + (19-3)_I$. This, in conjunction with other workers' results (cf. "Plant Breeding Abstracts," Vol. I, Abst. 209) is taken to shew that the genom of *juncea* is *aabb*.

The possible origins of the aberrant hybrids produced are discussed. COF_{1-IV} is considered to have arisen by somatic doubling, the others with duplicated maternal or paternal sets by irregularities in fertilization.

193. ROTH, H. 633.491:575(43)
Arbeiten, Ergebnisse und Züchterziele einer neuzeitlichen deutschen Kartoffel-
zuchtstätte. (**Work, results and breeding objects of a recent German
potato breeding institute.**)
Dtsch. landw. Pr. 1935: 62: 193-94.

An account is given of the experimental station of the firm "Ragis," at Muhlendorf in Further Pomerania. Between ten and twenty-five thousand seedlings a year are grown and in breeding for improved types the demands of both the German and the foreign markets are kept in view. German varieties of five types are produced, namely (1) early yellow varieties, (2) mid-early yellow varieties, (3) varieties of the Industrie type, (4) industrial varieties rich in starch and (5) fodder varieties with high yields. All must be wart-resistant and efforts are made to include also blight resistance. Brief descriptions are given of six of the best varieties recently issued and reference is made to certain others on which work is still in progress.

194. 633.491:576.312.34
ELLISON, W. 633.491:576.312.35
**A study of the chromosome numbers and morphology in certain
British varieties of the common cultivated potato (*Solanum tuberosum* L.)**
Genetica 1935: 17: 1-26.

Somatic metaphase plates of 42 varieties of potato were studied in the root tips, fixed in Benda's fluid. The somatic number $2n = 48$ was found to be constant for all varieties and no evidence was found of fragmentation. Two satellites were observed in many plates, and it is considered that every variety has probably two satellite-carrying chromosomes, but not more—evidence that the potato is an allotetraploid.

Owing to the uncertainty in some cases, of the position of the attachment constriction, studies on chromosome morphology were based entirely on length, determined by measurements of camera lucida drawings of flat plates selected in every case from cells in the cortex. The chromosomes are divided into size classes and the number occurring in each class in the respective varieties is tabulated. A great deal of variation was observed, particularly in respect of the large chromosomes ($2.8-3.2\mu$) which occurred in some varieties and not in others. In general the fertile varieties were found to have even numbers of chromosomes in the size classes and the more sterile ones had odd numbers. In the case of varieties derived by bud mutation from an existing variety (Field Marshall from Up-to-Date and Golden Wonder from Langworthy) there was a tendency for the chromosomes of the derived variety to be longer than those of the parent.

Over 100 seedlings were grown from berries produced by self-fertilization of Majestic and Flourball, and the chromosomes of about 50 of these, selected for abnormal foliage, were examined and found to be 48 in each case where satisfactory plates were obtained.

195. USPENSKY, E. M. 633.491:581.162
 (The biology of potato blooming.) 633.491:575.12:578.08
 Works Pot. Res. Inst. Moscow 1935: No. 8: Pp. 152.

An exhaustive account of the existing knowledge on the subject of flowering in the potato. Starting with the morphology of the flower, the general floral biology is described, with an account of the methods of crossing. The various factors which influence flowering are next discussed, followed by an analysis of methods whereby flowering can be artificially induced in varieties which normally do not flower. For this purpose observations were first made on the flowering of various types, especially those characterized by sparse flower formation, when grown under natural conditions in a number of different localities and with different times of sowing. The reaction of the varieties was different but a clear relationship was established between flowering and certain climatic conditions, moderate humidity and a fairly low temperature being particularly favourable. Reduced length of day had an inhibiting effect upon flowering, though southern and especially mountainous southern regions exerted a favourable influence and induced flowering and fruiting in certain varieties which entirely failed to flower elsewhere; thus the length of day is seen to be not the sole climatic factor regulating flower formation and Lyssenko's view that northern regions are most favourable to potato flowering and breeding has not been confirmed. It is evident that many factors in addition to length of day contribute to influence non-flowering.

These observations and those made on the effect of a number of different treatments to stimulate flowering in non-flowering varieties, lead the author to conclude that it is not the incapacity to flower which is inherited, so much as the capacity to flower only under a certain set of external conditions, which conditions differ for different varieties. By suitably adjusting these conditions, any variety, it is thought, can be induced to flower or prevented from flowering. This explains why certain varieties flower abundantly in some countries and not at all in others. However there are clear hereditary differences between varieties in the ease with which they can be induced to flower. The various methods applied for preventing the flow of assimilants away from the inflorescence were the most efficient means of stimulating flower formation in non-flowering forms. Of these the method of bending over of the stem at the time of flower bud formation was the most successful of all. Various methods of retarding growth, such as starvation, pruning, growing at reduced temperature, etc. gave negative results in the year of application but the plants formed from their tubers displayed clear signs of an after-effect and many non-flowering varieties in this way formed flowers. Methods which retard or prevent the formation of tubers also assisted flowering. By these various means all twenty-two of the non-flowering varieties tested were induced to form flowers at some time or other during the period 1924-1930. From a number of these, crosses were made and ripe berries and seeds obtained and so it has been possible greatly to enlarge the range of possible crosses and to make use of varieties possessed of many desirable features that it has not hitherto been possible to utilize.

196. REES-LEONARD, O. L. 633.491:581.3:576.356
 Macrosporogenesis and development of the macrogametophyte of
Solanum tuberosum.
 Bot. Gaz. 1935: 96: 734-50.

Developmental and cytological irregularities were observed and their possible bearing on the failure of seed formation in the potato is mentioned. Further investigations should determine, if possible, the relation between sterility and the above irregularities and also those observed in microsporogenesis and in pollen grain development.

197. DIEHL, R. 633.491-2.412.5
 Etat actuel de la maladie verruqueuse de la pomme de terre (la question des
 variétés). [Present state of the wart disease of potato (the variety
 question).]
 Rev. Path. Vég. 1934: 21(1): 25-31.

Observations have been made on the reaction to *Synchytrium* of a number of varieties of potato, including some of the new forms from South America. Among the latter four resistant varieties of *Solanum tuberosum* and four of *S. andigenum* have been found, whilst several of the other new *Solanum* species have proved susceptible. Further observations on a wider range of material are in progress.

198. SVETAŠEV, A. T.

633.51 Pakhtakor

(The variety No. 36 M₂ "Pakhtakor.")

Bull. Cent. Asia Sci. Res. Cott. Inst. (NIHI) Tashkent 1934 : No. 2 : 6-10.

This new cotton was produced by selection from Acala which when received from America was in a very impure state. The new selection is distinguished by high yielding capacity and extremely high quality of lint, in which it excels the standard Navrotskii : its average lint length is 30-35 mm., spinning 40-50's ; its ginning out-turn is slightly higher than Navrotskii and the bolls, though of the same size, are more abundant. It is 3-5 days later than Navrotskii, to which it is however superior in having a more compact habit of growth and to which it is regarded as a promising successor.

199. CHEVALIER, A.

633.51:575.12:576.16

Le *Gossypium anomalum* est un cotonnier. (*G. anomalum* is a cotton.)

Rev. Bot. Appl. 1935 : 15 : 369-70.

Genetic confirmation of the author's contention that *G. anomalum* Wawra et Peyr. belongs to the *Gossypium* and not to *Cienfuegosia* group. (Cf. "Plant Breeding Abstracts," Vol. III, Abst. 675.)

200. KONSTANTINOV, N. N.

633.51:581.143.26.035.1

[Photoperiodism of the cotton plant. (Some results of experiments on the influence of changes in the duration of illumination upon the development of the cotton plant).]

Sredaz NIHI, Moscow and Tashkent 1934 : Pp. 78.

Experiments were made at Tashkent in which cotton plants were subjected to daily periods of illumination of 6, 9 and 12 hours, with a control receiving normal daylight of an average duration of about 14 hours. Observations were made on all the plants at all developmental stages, leading to the conclusion that cotton is a short-day plant in the accepted sense, since a reduction of the daily period of illumination occasions an earlier maturity. Different varieties react differently however, the late perennial forms giving the most pronounced effect as a rule, while the early and ultra-early forms do not react at all ; some of the perennial forms also do not react. The forms with the most pronounced reaction are found to be usually of equatorial origin and with increasing distance of the place of origin from the equator the reaction generally becomes less pronounced. Forms differing markedly in reaction are found within nearly all the systematic species but certain clearly defined endemic groups can be established on the basis of the photoperiodic reaction. The optimum period of illumination is also different for different forms, varying between 8 and 12 hours daily.

The reaction of the plant to reduced length of day is to produce sympodial branches at a lower level and so form flower buds and bolls at an earlier date. The habit of the plant and the form of the vegetative organs is often also altered.

By suitably adjusting the length of day it is possible to induce the most diverse cottons to flower simultaneously and by this means crosses have now been made between the Egyptian cottons, with low boll weight, and a number of the South American cottons, *Gossypium peruvianum*, *G. brasiliense* etc., which though perennial in habit have very large bolls, weighing up to 7 and 8 g.; these cottons are phylogenetically close to the Egyptian cottons *G. barbadense*. The F₁ hybrids are also perennial in habit and must also be treated with short day.

201. MALINKOVSKY, M.

633.51:581.162.32

(Natural cross-pollination of commercial cotton varieties.)

Bull. Cent. Asia Sci. Res. Inst. (NIHI) Tashkent 1934 : No. 2 : 41-51.

Sowings were made of a number of varieties in alternate rows, in a field where a quantity of other lines were also grown, thus under conditions favouring the maximum degree of cross-pollination. The examination of the progeny in the following year showed that the average cross-pollination for all the Upland varieties was 4.62 per cent, 2.87 per cent of the progeny being hybrids with plants of the adjacent row and 1.84 per cent with other plants, evidently

produced by out-pollination by insects. Different varietal combinations however gave differing degrees of cross-pollination, one group shewing 6.85 to 8.48 per cent, another only 0 to 4.70 per cent. The degrees of pollination observed in the different varietal combinations are tabulated; the highest percentages were observed in the forms with compact habit.

The low degree of contamination observed under these optimum conditions leads to the conclusion that out-pollination need not be a serious source of impurity in *elite* material if proper control of the nursery and of the seed is observed.

202. NAGHIBIN, Y. and UZEMBAEV, E. 633.51:581.162.32
(**The extent of cross pollination in cotton.**)

Bull. Cent. Asia Sci. Res. Cott. Inst. (NIHI) Tashkent 1934 : No. 2 : 33-40.

A strip of a red-leaved Upland variety, No. 1617, was sown in the centre of a field of the new variety 8516 having green leaves; the seeds were collected and their progeny examined in the following season. The results of this examination are tabulated and shew that the highest percentage of cross-pollination, amounting to 5.22 per cent, occurred in the rows adjacent to the strip and diminished rapidly with increasing distance from the strip. It is calculated that, since this cross-pollination is effected by insects, spatial isolation is thoroughly reliable only when the distance of isolation is equal to 1 km., though isolation at a distance of 15 m. has given practically satisfactory results.

There was a difference in degree of cross-pollination to the east and to the west of the strip, connected with the direction of the prevailing winds.

203. POD'JAPOL'SKII, S. P. 633.51:581.162.32
(**Cross-pollination in cotton.**)

Bull. Appl. Bot. Leningrad 1934 : Ser.A (12) : 141-52.

The cotton flower is shewn to be designed both for self-pollination and for entomophilous cross-pollination; pollination is effected by a variety of insects, though the honey bee plays a small role if any. The wind plays no part in pollination and even in very strong winds of 8-20 m. per sec. the average number of pollen grains per sq. cm. falling on detector slides placed at different distances from the plant was only 0.3.

An experiment was made to test the degree of natural cross-pollination by sowing red and green leaved varieties together and counting the number of red leaved plants in the progeny of the green variety. With the increase of the proportion of red plants from 0.1 to 10 per cent the number of hybrids rose from 0.14 to 3.18 per cent. The progeny of the red plants was then examined. The red and green varieties differed in a single factor pair and the hybrids were distinguishable by their paler red coloration. The number of such hybrid plants proved to be as much as 32 per cent, which high percentage is attributable to cross-pollination from the neighbouring plants, since the experimental plot was surrounded by green plants.

A further experiment was made by planting a few rows of red plants in a field of green, three rows of green being also planted between each two rows of red. In this case the number of hybrid plants in the green progeny came to 1.28 per cent. Two varieties of red leaved plants were used, Wellet's Red leaf and Wine Sap; again the latter had 40.8 per cent of hybrids in the progeny, the former 58.0 per cent. The second generation was grown from some of these plants, without isolation from the surrounding green plants, and proved to contain 16.5 per cent of green plants.

It is calculated, assuming 60 per cent cross-pollination, that 12.25 per cent green plants would result from out-pollination from green plants, and 4.07 per cent from segregation after self-pollination, giving a total of 16.3 per cent, which is extremely close to the observed percentage.

Further observations are reported which confirm the high percentages of cross-pollination cited here. For instance in the progeny of a plant with brachytic fruiting branches 42 per cent of the dominant normal were observed. N. F. Zulinov reports an average set of 54 per cent in flowers of the variety Schroeder, left free after emasculation. A comparatively large proportion of natural hybrids with Old World cotton has always been observed at Tashkent in hybrid populations of Old and New World species and also in the ordinary breeding material at all stations working with cotton.

In further observations on Wine Sap, the percentage of hybrids in the green progeny fell from 0.6 to 0.1 as the distance between the plants was augmented from 0.7 to 7.9 m.

These findings make it clear that the amount of contamination caused by the presence of a few foreign plants in a pure culture of cotton is extremely small, amounting to a fraction per cent, and this percentage rapidly falls still further as the distance from the impurity increases. However, the degree of contamination occurring in a single plant by out-pollination from the surrounding population is very much higher and the common method of estimating the degree of cross-pollination by examining the progeny only of the green plants is seen to be definitely fallacious.

204. NAKATOMI, S. 633.51-1.557:575.127.2
(An interspecific hybrid between American and Asiatic cotton plants and its progenies.)
 Proc. Crop. Sci. Soc. Japan 1935 : 7 : 3-11.

Attempts to produce the hybrid between old world cotton ($n = 13$) and new world cotton ($n = 26$) were largely unsuccessful. After seven years the author obtained six F_1 plants from the cross King's Improved (new world) \times Manchurian Black (old world), and one F_1 from Egyptian (new world) \times Manchurian Black. On pollinating the latter with King's Improved, two seeds were obtained, one of which developed, the plant flowering and setting fruit. This plant somewhat resembled King's Improved, but had characters of all three parents. Its chromosome number was $n = 26$, and it was partially fertile, with about 10 per cent fertility on self-pollination and about 20 per cent when pollinated with King's Improved. After the two types of pollination, the respective percentages of ginned cotton obtained varied from 25.00-40.80 and from 21.25-48.80; the respective lengths of fibre varied from 23-29 mm. and from 23-26 mm. Nineteen offspring were obtained in all, six from self-pollination and 13 from the back-cross. The plants varied a great deal in all characters. The back-cross progeny had more good pollen (47.74 per cent—88.92 per cent as against 21.40 per cent—40.84 per cent in the progeny from self-pollination). The percentage of ginned cotton in the self-pollination progeny varied from 28.09 per cent to 40.84 per cent, and in the back-cross progeny from 33.12 to 43.75 per cent, while the lengths of fibres of the respective progenies were 24.35-36.70 mm. and 20.30-29.80 mm.

205. TSIVINSKII, V. N. 633.51-2.112:581.1
 633.51:575"793":577.15
(Drought resistance and earliness in cotton.)
 Sredaz NIHI, Moscow and Tashkent 1934 : Pp. 102.

Observations were made on the relative drought resistance of a number of varieties and an attempt made to correlate this with various physiological factors. Transpiration rate was related in a certain measure to drought resistance, but with a number of reservations. The concentration of the sap was not so associated and the character of the root system was found to be an important consideration.

As regards earliness, no connexion could be observed with peroxidase or catalase content, though the lipase activity in germinating seeds may prove to be a useful criterion.

206. BĒRZIŅŠ, E. 633.52:575.41-181.12:581.44(47.4)
 Daba waj larweeschu semneeks weetejo garaudschu linu istopejs? **(Do we owe the production of the local long stemmed flax to natural selection of the Latvian cultivator?)**
 Latv. Lauksaimn. 1935 : Nos. 8-10 (Suppl.) : Pp. 16.

The still prevalent fallacy that environmental conditions can produce a change in the length of stalk characteristic of a particular type of flax is refuted. Research at the Stende Seed Breeding Station demonstrates (in opposition to Schindler) that in mixtures of various forms natural selection always tends to eliminate the long stemmed types in favour of the short stemmed forms which bear more seed. The excess of long stemmed varieties in many districts of Latvia is due not to natural selection but to the skill and care of the grower, who has been taught by tradition to recognize the value of the local varieties of flax with long stalks.

207. 633.52-2.484-1.521.6:581.43:575
633.52-2.42-1.521.6
BOYLE, L. W.
Histological characters of flax roots in relation to resistance of wilt and root rot.

Tech. Bull. U.S. Dep. Agric. 1934 : No. 458 : Pp. 18.

In this investigation five pure lines, resistant, partially resistant and susceptible, to fungi infesting the soil were used. The literature reviewed and the technique for the greenhouse and field tests is described.

Resistant and partially resistant or susceptible strains were found to differ in the stability of the cortical cell walls of the roots, as determined by their resistance to hydrolysis by sulphuric acid and the amounts of non-hydrolysable substances they contained.

Consideration of histological observations and data from field plantings suggests that resistance to root rot depends on the more rapid and marked development of stability in the cortical cell walls of the root of resistant types as compared with susceptible varieties.

From the present experiments and other studies it is assumed that the resistance to the root rot type of fungi or cortical invaders, and to the wilt-producing type of vascular invaders is due to different and independent characteristics of the flax plant—a point of obvious importance in the estimation of genetic resistance.

208. 633.522:581.331.2:576.356.5
633.522:581.331.2:578.088.2
BRESLAVEC, L. P.
(Differential fertilization of the hemp plant.)
C.R. Acad. Sci. U.S.S.R. 1935 : 2 : 297-302.

Pollen grains were observed in hemp to be of widely differing sizes, which suggested the possibility of obtaining triploid plants by using the largest grains for pollination, as has been done in other plants. A method is described whereby the grains could be observed under the microscope and grains of desired size removed by means of steel or glass microneedles and so used for pollination. It is thought that if triploid plants are obtained they will probably display sex changes. Pollen grains of different sizes have been observed also in a number of other plants.

209. 633.522-1.541:581.331.2:576.16
633.522:577.8
BRESLAVETZ, L. P.
Abnormal development of pollen in different races and grafts of hemp.
Genetica 1935 : 17 : 154-69.

In normal hemp, although a number of pollen tetrads are regular, following a regular meiosis, other tetrads on the same plant or even in the same pollen sac may be abnormal as a result of irregularities at meiosis. In the male flowers of plants which had been grafted with a view to changing their sex, much more striking irregularities were observed, from the archesporial stage onwards, and these may be considered an exaggeration of those occurring in normal hemp.

The mature pollen of normal hemp consists mostly of good pollen grains, shrivelled grains being rare. There is however, a great variation in size, from giant grains with a diameter of 68.9μ down to minute ones with 18.6μ . In respect of variability of pollen size, the races of hemp examined fell into two groups, one having the typical frequency curve with a steep slope and a high peak, while the other, characterized by greater variation shewed curves with two peaks or else even more irregular curves.

Attempts to separate out the giant grains by centrifuging failed. Preliminary experiments indicated that all classes of grains germinate.

The author considers that hemp is in process of losing its capacity for sexual reproduction, some races more than others, and compares the course of microsporogenesis in normal hemp to gametogenesis in those Lepidoptera where apyrene and eupyrene sperms are produced.

SUGAR PLANTS 633.6

210. PANSHIN, B. A.

633.61:575(47)

(Sugar cane.)

Bull. Appl. Bot. Leningrad 1934 : Ser.A (13) : 59-73.

A short general review is given of sugar cane and its cultivation, including a brief résumé of the recent work in genetics and breeding. The possibilities of cultivating cane in the dry subtropics of the Soviet Union are discussed. The studies so far made at Sukhum have led to the conclusion that this will only be possible if suitable forms for the district can be found, either by hybridization with the existing subtropical forms, or by the discovery of forms of a type hitherto either unknown or not used in cultivation. These are being sought for among the wild Indian canes, *Saccharum Barberi* or *S. sinense*. A third possibility is vernalization. It is hoped by crossing with *S. spontaneum*, and with sorghum to produce suitable canes which ripen in 6-7 months. Wild *S. spontaneum* grows in Central Asia and it is proposed that an expedition should be sent there to make as complete a collection of it as possible.

211.

633.61:575.12

633.61-1.547.25:575.42-181

LENNOX, C. G.

633.61:576.312.35

Genetics. Report of Committee in Charge of the Experiment Station.

Proc. 54th Ann. Meet. Hawaii. Sug. Pl. Ass. 1934 : 38-45.

An account is given of the latest crosses affected and of the tests carried out on the selections made from the seedlings resulting from earlier crosses. These crosses include the varieties D 625, Mahona, Q 813, P.O.J. 100, and Co. 290, all of which flowered for the first time.

In seedling selection, it has been found that selection based on size of seedling in the germinating plants is a criterion of no value, groups of "large" and "small" seedlings having approximately the same proportion of valuable seedlings as judged by later tests.

A study of the chromosomal constitution of the New Guinea *S. robustum* indicates a chromosome number very close to that of the noble canes, i.e. 40 haploid, and with small variation. "Pyramidization" of the number of chromosomes in *robustum* hybrids is not to be expected nor does it actually occur as studies in such hybrids have indicated. H. M. L.

212.

633.61:575.127.5:633.62:581.41

BOURNE, B. A.

633.61:575.127.5:633.174:581.41

A comparative study of certain morphological characters of sugar cane x sorgho hybrids.

J. Agric. Res. 1935 : 50 : 539-52.

In all, 345 hybrids between sugar cane, *Saccharum officinarum* L. and sweet sorghum, *Holcus sorghum* L. var. *saccharatus* (L). Bailey were obtained but only 128 reached maturity. The varieties used were P.O.J. 2725 sugar cane as female parent with Texas Seeded Ribbon sorgho and Early Orange sorgho as male parents. Physiological studies on pollen germination showed that sorgho pollen shed between 6 and 8 a.m. was needed for good germination. The sugar cane stigmas were bagged from late evening until 10 a.m. throughout the flowering period, to exclude rain and dew and keep the osmotic pressure as high as possible. No success was obtained in a single attempt at the reciprocal cross.

In width of leaf and diameter of stem the hybrids were on the average intermediate between the parents, but in height, though there was great variation, the average was significantly less than either parent. The bud groove in the internodes characteristic of sorgho appeared in almost all hybrids.

The structure of the spikelets of one hybrid was studied and many irregularities were found, including florets with two ovaries and 4 or 5 stigmas. Relatively few hybrids have produced inflorescences though many have "boented."*

The epidermal characters of the parents and several hybrids were also studied, owing to the value of these in identifying sugar cane varieties. In diameter of cells the hybrids were intermediate ;

* A term used in sugar cane literature when referring to the tapered or spiked appearance of the apical growing point of the stalk prior to the emergence of the inflorescence.

a significantly greater density of stomata in the P.O.J. 2725 x Early Orange hybrids compared with P.O.J. 2725 x Texas Seeded Ribbon sorgho hybrids was correlated with abundant stomata in the Early Orange parent. The occurrence of other types of cells in the epidermis is also described.

About 3 per cent of the mature hybrids have shown sufficient vigour to warrant further field trials.

213. 633.61-2.483-1.521.6:575
632.483:576.16:633.61
ABBOTT, E. V. 633.61-1.547.1:575
Economic importance of red rot and comparative susceptibility of some sugarcane varieties in the southern United States.
Circ. U.S. Dep. Agric. 1935 : No. 350 : Pp. 26.

In spite of the evidence of the existence of physiological forms of *Colletotrichum falcatum* the widespread failure of P.O.J. 213 in resistance to red rot is not in the author's opinion due either to the difference in virulence of various strains of the fungus or to a change in the inherent resistance of the cane. The problem of physiological forms is, however, still being investigated.

The results of laboratory and field experiments on the comparative susceptibility of commercial varieties and certain promising new seedlings are discussed and it is thought possible that a susceptible variety that germinates rapidly with vigorous root formation might be able to resist the type of infection due to penetration through the root rings. It is also suggested that certain varieties may be more resistant when actively growing than when in the dominant state.

Varietal differences in resistance to rind disease fungus (*Melanconium Sacchari*) were also observed.

A subsidiary study was made of the relative germination capacity of sugar cane varieties.

214. 633.61.0015(73)
633.61 C.P. 28/19
ARCENEUX, G., 633.61-2-1.521.6(73)
STOKES, I. E. and KRUMBHAAR, C. C. 633.61:575(73)
Variety tests of sugar canes in Louisiana during the crop year 1932-33.
Circ. U.S. Dep. Agric. 1935 : No. 343 : Pp. 35.

Detailed results of the performance, including disease and pest resistance, of numerous canes. Special mention is being made of the new seedling C.P. 28/19, the parentage and characteristics of which are given with those of certain other canes.

215. BONNE. 633.63:575.127.2:633.416:581.43
Die Züchtung einer aus dem Boden herauswachsenden Zuckerrübe (sogen. grünnköpfige Zuckerrübe). [**The breeding of a sugar beet with emergent roots (the so-called green-headed sugar beet).**]
Dtsch. Zuckerindustr. 1935 : 60 : 353-56.

The advantages of a form of sugar beet that grows more or less protruding from the ground are discussed, greater ease of harvesting and cultivation being the chief. In order to attain such a form whilst preserving the high yield and sugar content characteristic of the sugar beet, crosses have been made between the sugar and forage beets, but these have not been a success, partly owing to the too distant relationship of the two forms, for it has been observed that neither the original *Beta maritima* nor the wild species of Anatolia have any tendency to produce emergent roots. A beet of the desired type produced by Strube is described however and its origin traced to hybridization of the long white forage beet with sugar beet followed by back-crossing with sugar beet. By repeated selection for the emergent character in this material, without particular regard to the sugar content, a type has been produced in which the entire hypocotyl and part of the root grow above ground, i.e. about one-third of the part used in the factory. The actual expression of the character varies considerably with the season. When a relatively constant line was reached, selection for sugar content, which at first proved

very low, began, and by repeated selection this was brought to within $\frac{1}{2}$ –1 per cent of that of Strube's E lines. The sugar content of the terrestrial portion was about 1 per cent lower than that of the subterranean part. Tests over a number of years have shown the various factors determining commercial quality to be not inferior to those in the E lines. The percentage of white to pink seedlings was 1:1.1 as compared with 1:2.9 for the E (high yield) and 1:4.3 in the Z (high sugar) sugar beets.

The new form gives indications of being more resistant to black aphid than other sugar beets and though in field tests it has been somewhat more damaged by certain other pests it is thought that this will not be so on a field scale.

STIMULANTS 633.7

216. KOSTOFF, D. and RAJABLY, I. 633.71:575.127.2:576.312:576.356.4

(Cytogenetic studies of certain composite hybrids in *Nicotiana*.)

Bull. Inst. Genet. USSR. 1935: No. 10: 29–63.

Some of the plants produced by back-crossing the self-sterile hybrid *N. rustica* L. var. *humilis* x *N. Tabacum* L. to *N. Tabacum* had 72 chromosomes, i.e. a whole set from *N. rustica* ($n = 24$) and two whole sets from *N. Tabacum* ($n = 24$), were partially self-fertile, and in appearance were intermediate between *N. Tabacum* and the F_1 hybrid. Among their progeny appeared plants grading between *N. rustica* and *N. Tabacum*. Two plants were selected which resembled the back-cross parent and were each crossed with *N. glauca* Grah ($n = 12$) and one with *N. sylvestris* Speg. and Comes ($n = 12$); the plants used as female parents had 70 and 68 somatic chromosomes respectively.

The resulting progeny, which were triple hybrids, varied greatly in appearance, some shewing characters of one or more of their three parents, others apparently representing something quite new, e.g. some had very narrow leaves, a character which did not appear in any of their parents.

In general, *rustica* characters were not very prominent indicating that the full complement of *rustica* chromosomes was not present.

The cytology of the plants was also studied and followed roughly the same general plan in each case. The somatic chromosome numbers varied from 45 to 68. Meiosis was irregular, multivalents and univalents being observed at metaphase I in each case, and meiosis was apparently delayed as compared with the pure species. Restitution nuclei were found in many plants and dyads were formed as a consequence, though the percentages of viable pollen grains were often less than was to be expected from the number of restitution nuclei, which is attributed to the delaying of meiosis. As a result of the very irregular meiotic divisions the majority of the pollen grains were non-viable. The large somatic numbers of the triple hybrids indicate that eggs with smaller numbers had been inviable.

To explain the production of compound hybrids involving species which are incompatible when crossed directly (e.g. *rustica* and *sylvestris*), it is suggested that those genes which cause disharmony, i.e. which tend to direct development in very different directions, have been eliminated when chromosomes were lost in the hybrid parents' meiotic divisions.

The occurrence of plants with long and narrow leaves such as none of the parent species possessed may be due to the setting up of a different genic balance arising from the duplication of chromosomes of certain of the parent species, or it may possibly be due to hybrid mutation, as found by Kostoff in *Capsicum* (see "Plant Breeding Abstracts," Vol. I, Abst. 473).

217. KOSTOFF, D. 633.71:575.127.2:576.354.4

Studies on polyploid plants. II. Cytogenetics of the trigonometal triple hybrid (*Nicotiana rustica* x *N. Paniculata*) x *N. caudigera*.

Bull. Inst. Genet. USSR. 1935: No. 10: 19–28.

By pollinating *N. rupa* (the almost constant breeding amphidiploid from *N. rustica* x *N. paniculata* with 72 somatic chromosomes) with pollen from *N. caudigera* ($2n = 24$) a number of seeds were obtained, only one of which germinated and produced a plant which was a triple hybrid with 24 *rustica* + 12 *paniculata* + 12 *caudigera* chromosomes. The hybrid was intermediate between *rupa* and *caudigera* and was self-sterile.

Meiosis was irregular, 12 bivalents being formed by conjugation of the 12 *paniculata* with 12 *rustica* chromosomes and 24 univalents made up of the remaining chromosomes. Occasionally a restitution nucleus was formed after division I, leading to the formation of dyads and large viable pollen grains. The latter which germinate poorly and whose pollen tubes grow very slowly only occur to the extent of 0.03 per cent.

Chromosome behaviour of the hybrid is compared with that in *N. triplex* (see "Plant Breeding Abstracts," Vol. IV, Abst. 1052).

Although all the parents of the triplé hybrid were from very uniform strains and apparently homozygous, the one seed which germinated must have been different from those which did not. This may be due to (1) physiological differences between morphologically identical plants or (2) mutation during gametogenesis, probably in *N. rupa* or possibly in *N. caudigera*, or (3) crossing-over between *rustica* and *paniculata* chromosomes in *N. rupa* during the formation of quadrivalent chromosomes, resulting in diversity among the gametes of the amphidiploid.

218. KOSTOFF, D. and RADJABLY, I. 633.71:575.127.2:576.356.5
633.71:575.129:576.354.46
Studies on polyploid plants. IV. Cytological studies on *Nicotiana rustica-paniculata* polyploid hybrids.
Bull. Acad. Sci. URSS. 1935 : 115-28.

The 36 chromosome hybrid between *N. rustica* ($2n = 48$) and *N. paniculata* ($2n = 24$) has a very irregular meiosis. Usually 12 bivalents are formed by association of *paniculata* and *rustica* chromosomes, the other 12 *rustica* chromosomes usually remaining in the univalent condition but sometimes associating with the paired chromosomes to form some trivalents, an indication that *N. rustica* is a polyploid species. By the formation of a restitution nucleus in a proportion of pollen mother cells and occasionally the fusion of two metaphase II spindles, unreduced pollen grains are formed to an extent which varies with temperature, being increased by low temperatures. By pollinating the hybrid with *N. rustica* pollen, progeny with varying chromosome numbers were obtained, including a number with 60 chromosomes, resulting from an unreduced female gamete of the hybrid. Here again meiosis was very irregular, varying numbers of bivalents, univalents and trivalents being found, and unreduced pollen grains formed as a result of a restitution nucleus. These plants, with two complements of *rustica* and one of *paniculata* chromosomes are termed heterotriploids.

By pollinating the heterotriploids with *N. paniculata* pollen, about 80 plants were obtained, two of which on cytological examination proved to have 72 chromosomes, resulting from an unreduced female gamete of the heterotriploid. These were therefore amphidiploids, named *N. rupa*, having two complete sets of *rustica* and *paniculata* chromosomes. Meiosis was not as regular as is usually described in amphidiploids, about three quadrivalent chromosomes being usually formed. Fertility is somewhat reduced, about 15-25 per cent abortive pollen grains are formed, and the hybrid is not absolutely constant.

219. KHMURA, M. J. 633.71:575.127.2:581.192.7
Chemical characteristics of some *Nicotiana* species.
Researches on the chemistry of tobacco. (VI). Bull. State S.-R. Inst. Tobacco and Makhorka Ind. (Witim) Krasnodar 1935 : No. 125 : 107-16.

Studies are being made on the inheritance of nicotine in a number of interspecific hybrids and the first section of the work, consisting of analysis of the alkaloids in the pure species, is here described. Representatives of the four sections *Tabacum*, *Rustica*, *Petunioides* and *Polidichia*, embracing seventeen different species, were examined chemically at the time of flowering, omitting the two species which have been most studied by former investigators, *N. Tabacum* and *N. rustica*. The results shew that the principle contained in most species consists of a mixture of alkaloids, volatile and not volatile, though certain species contain no volatile alkaloids. The melting points of the picrates for the species having volatile alkaloids are given; they vary between 178 and 213°C. *N. glauca* behaved differently from the rest in that the picrate had no definite melting point, indicating that the volatile alkaloid in this species was also a mixture. This was confirmed by dissolving in hot water and by fractional distillation.

The nitrogen and protein contents of the different species are also given, together with the proportion of carbohydrates to proteins (Schmuck Number). This was low in all species, since they all contained less carbohydrate and more protein than *N. Tabacum*. Some species contained considerable quantities of citric acid, e.g. 6-9 per cent in *N. glauca*, 5 per cent in *N. glutinosa* and *N. plumbagenifolia*, 4 per cent in *N. paniculata* and in *Petunia*; this suggests that by suitable interspecific crossing forms might be produced with still higher citric acid content. Malic acid occurs in some species in quite high proportions too, and the salt content of some is also quite high.

220. KOSTOFF, D. 633.71:575.129:576.356.7
(Studies on the polyploid plants. X. On the so-called "constancy" of the amphidiploid plants).
 C.R. Acad. Sci. URSS. 1935 : 1 : 653-57.

The first investigators of amphidiploids emphasised the constancy of these forms, due to the unvarying autosyndetic pairing of their reduplicated chromosome sets, as in *Raphanobrassica* ($2n = 36$, from *Raphanus sativus*, $n = 9 \times Brassica oleracea$, $n = 9$) and *Nicotiana digluta* ($2n = 72$, from *N. glutinosa*, $n = 12 \times N. Tabacum$, $n = 24$). Amphidiploids have now been produced from *N. rustica* ($n = 24$) \times *N. paniculata* ($n = 12$) giving *N. rupea* ($2n = 72$) and from *N. glauca* ($n = 12$) \times *N. Langsdorffii* ($n = 9$) giving *N. Vaviloviana* ($2n = 42$). In the F_1 (unduplicated) hybrids the *paniculata* chromosomes pair with 12 *rustica* and the *Langsdorffii* pair with 9 *glauca* chromosomes. In the amphidiploids, as well as bivalents, quadrivalents are formed at metaphase I, leading to two types of variations: (1) chromosomal aberrations and pseudoamphidiploidy, (2) variations due to crossing-over between chromosomes from different parental species. In *N. Vaviloviana*, in addition to the forms arising from the various types of distribution following quadrivalent formation, found in *N. rupea*, one plant with 23 chromosomes (of parthenogenetic origin) and another with 48 were found. The variations due to crossing-over were greater in *N. Vaviloviana* than in *N. rupea* and it is suggested therefore that, since *paniculata* chromosomes resemble *rustica* more than *Langsdorffii* resemble *glauca* chromosomes, *paniculata* is closely related to *rustica* and may have participated in its origin, *rustica* being an amphidiploid formed from *N. paniculata* and some other $n = 12$ form. Having found 5 to 8 bivalents in the F_1 hybrid *N. glutinosa* \times *N. Tabacum* var. *macrophylla*, and 8-10 in the F_1 *N. glutinosa* \times *N. triplex*, the author considers that the possibility of quadrivalent formation in the corresponding amphidiploids should not be excluded.

221. RAVE, L. 633.71:575.45:575.11
 Beitrag zur Blattbasis beim Tabak. (A note on the leaf base of tobacco.)
 Gartenbauwiss. 1934 : 9 : 1-19.

The results of crosses between strains of the red flowered *Tabacum* variety shewed the existence of latent factors for stalked leaves in certain strains. No genetical analysis was undertaken but the use of crossing experiments as a method for the determination of systematic relationships is discussed.

222. KOSTOFF, D. 633.71:576.312.36:578.088.2
 635.651:576.312.36:578.088.2
(Changes in karyotypes induced by centrifuging.)
 C.R. Acad. Sci. URSS. 1935 : 2 : 71-76.

By centrifuging germinating seeds of *Vicia*, *Nicotiana* and *Triticum* alterations in the karyotype were induced. Occasionally, as a result of disturbing the mitotic processes, chromosome separation was prevented and tetraploid cells were produced. In *Vicia Faba* such cells divide at a lower frequency than diploid cells and are supplanted by the latter, so that tetraploid shoots are not formed, but in *Nicotiana Langsdorffii* the tetraploid cells have approximately the same division frequency as diploid cells and so tetraploid shoots may be produced. Other irregularities include unequal distribution of chromosomes at a division, translocations, and fragmentation. The last is of particular interest as in the present investigations it seems to occur most frequently at the spindle fibre attachment, so that the fragments preserve their individuality through succeeding divisions.

223. KOSTOFF, D. 633.71:576.354.46:575.113.42
(Conjugation between morphologically different chromosomes in *Nicotiana* species hybrids.)
 C.R. Acad. Sci. URSS. 1935 : 1 : 558-60.

Although the chromosomes of *N. glauca* are longer than those of any other *Nicotiana* species, they conjugate quite readily with morphologically different chromosomes in crosses with many other species. Again, *N. suaveolens*, the Australian species, has chromosomes differing morphologically from those of certain American species, yet they pair to a greater or less extent when crossed. In haploid *N. Langsdorffii* and *N. sylvestris*, conjugation between morphologically different chromosomes has also been observed.

The author suggests that the numerous genes conditioning the quantitative characters, (the polymeric genes in general) located in different chromosomes may regulate the attraction between non-homologous chromosomes and between morphologically different chromosomes in species hybrids, when the polymeric genes are related to each other in the same way as are allelomorphs. Thus conjugation between morphologically different chromosomes and between "non-homologous" chromosomes occurs in the homologous segments, however small, of such chromosomes.

224. OLMO, H. P. 633.71:576.356.4:575.1
Genetical studies of monosomic types of *Nicotiana tabacum*.
 Genetics 1935 : 20 : 286-300.

By repeated backcrossing of *N. sylvestris* x *N. Tabacum* var. *purpurea*, which shews $12\pi + 12i$ at meiosis, to *Tabacum* monosomic types lacking one of the chromosomes homologous with those in *tomentosa* can be produced and similarly by back-crossing the *tomentosa-Tabacum* hybrid, types monosomic for chromosomes homologous with those in *sylvestris* are obtained. The types studied in the present work, haplo -A, -B, -C and -F ("*tomentosa*" monosomics) and haplo -N, -Q and -R ("*sylvestris*" monosomics) were obtained in this way, except F ("*fluted*"). The characteristics whereby the various forms may be recognized are given. They produce much less seed than normal plants, their pollen is dimorphic, their viability is reduced and their development retarded.

The transmission of the monosomic condition through the ovules is high, monosomics in the progeny of the cross monosomic ♀ x normal varying from 45.6 per cent in haplo-N to 83.2 per cent in haplo-A. When these figures are corrected for the lower germination percentages obtained in this cross, the corrected percentages of (2n-1) plants vary from 68.0 to 87.4, shewing that considerably more than 50 per cent of the functional gametes are (n-1), probably owing to elimination of univalents. Moreover, the percentages so obtained were greater in some cases than the percentages of (n-1) pollen grains estimated by counting microcytes and micronuclei in the tetrads, suggesting that elimination of univalents may occur more frequently in the ovules than in the pollen mother cells.

The transmission in the pollen is very low, the proportion of monosomics from the cross normal ♀ x monosomic ♂ varying from 0 in haplo-C to 7.3 per cent in haplo-F. A relatively high proportion of aberrant types was also obtained in such crosses.

The results are discussed in relation to other monosomics studied by various workers.

225. KOSMODEM'JANSKII, V. N. 633.71:581.192.7
(On forms of tobacco with low nicotine content.)
 Sci. Tech. Bull. Mikoian's State S.-R. Inst. Tobacco and Makhorka Ind.
 Krasnodar 1935 : No. 1 : 50-58.

Examination of the nicotine content of a number of different types of tobacco indicates that it is not in any way directly connected with the quality or flavour of the tobacco. Analyses were made of a large number of varieties in 1934 and shewed the average nicotine content to be 1.01-2.0 per cent, with a maximum of 3.9 per cent ; a relatively large number of forms had a nicotine content of $0.08 \pm$ per cent. These low nicotine forms were mostly varieties from America or from Greece and Turkey ; they are of high quality and the Greek and Turkish forms are genetically related to the Russian forms, which have partly originated from them, in view of which there would appear to be no obstacle to the reduction of the nicotine content of the Soviet tobaccos by breeding.

226. KOSTOFF, D. and PROKOFIEVA, A. A. 633.71:581.331.23:576.356.5
(Studies on pollen-tubes. I. The growth potency of the pollen-tubes
in *Nicotiana* in connection with the length of the styles and some other
factors.)

Bull. Inst. Genet. USSR. 1935 : No. 10 : 65-82.

From the success or failure of crosses between *Nicotiana* species it can be seen that there is a tendency for pollen tubes of species with longer styles to have a greater growth potency. Similar results were obtained when pollen grains of a number of *Nicotiana* species and hybrids were grown *in vitro* on culture medium ; it was found that pollen tubes reached a greater length in the case of species with longer styles, and that they grew more rapidly and for longer periods. Other factors influence pollen tube growth in interspecific and intergeneric hybridization. Thus the breadth of the pollen tube seems to be correlated, at least as between related species or parents and hybrids, with chromosome number, and pollen tube diameter has an important effect on rate of growth in the style, i.e. the broader the tube the more slowly it grows. This is particularly true of autopolyploids, e.g. in tomato, where n pollen tubes reach the ovaries of $2n$ and $4n$ plants, while $2n$ pollen tubes reach the ovary only in $4n$ plants.

227. SHIMURA, T. 633.72:576.312.35:576.356.5
(Cytological investigations in tea plants.)
Proc. Crop Sci. Soc. Japan 1935 : 7 : p. 121.

The cytology of the following strains of tea was studied : " Ordinary " (*Thea sinensis* L.) 8 strains, " Chinese " (*T. sinensis* L.) 1 strain, " Koka " (*T. sinensis* L. var *vosea* Makino) 1 strain, " Koro " (*T. sinensis* L. *macrophylla* Sieb.) 2 strains and Indian (*T. sinensis* L. var. *assamica* Rierre) 2 strains.

Makinohara-wase, one of the " ordinary " strains was found to be triploid, with 45 chromosomes in root tip cells. Meiosis in pollen mother cells was very irregular, 3-6 univalents, 9-12 trivalents and corresponding numbers of bivalents being found. About 50 per cent of good pollen grains were formed.

All the other strains were diploid with 30 chromosomes in the root tip cells and regular meiosis, except in " Koka " strains, where lagging chromosomes were occasionally seen at anaphase I. Usually 90-98 per cent of good pollen grains were found, but in some cases 65-87 per cent were noted.

228. FREIRE, C. V. 633.73(81)
Contribuição ao estudo histológico dos cafeeiros no Brasil. (Contribution
to the histological study of the coffee bushes of Brazil.)
Rev. Dep. Nac. Café, Rio de J. 1935 : 2 : 915-16.

A continuation of the previous studies (see " Plant Breeding Abstracts," Vol. V, Abst. 765 and 1079), consisting of studies of the leaf characters, certain of which are indicated as a means of distinguishing between *Coffea arabica* and *C. canephora*.

AROMATIC PLANTS, SPICES, ETC. 633.81/4

229. NESTERENKO, P. A. and KNIŠEVETSKAJA, T. I. 633.812:575:668.5:581.49
(On the methods of breeding essential oil plants. The determination
of the oil content of *Lavandula vera* D.C. by the glands.)
Bull. Appl. Bot. Leningrad 1934 : Ser.A (12) : 37-46.

Observations on Crimean lavenders have shewn the oil content to vary from 0.5 to 9.0 per cent of the dry weight (0.2-3.0 per cent of the fresh inflorescence). The ether content of the oil also varies from 12 to 73.0 per cent. The best of these figures shew a marked superiority to the best French lavenders. Among the forms examined the proportion having an oil content of 8.9 per cent is only about 2 per cent of the whole. Thus the first problem in breeding is to raise the oil content and quality of the forms grown.

The combination of high oil content and high quality of the oil is rare : out of 398 forms examined only 5 had an oil content of 6-7 per cent and an ether content of 55-70 per cent, and only 8 had an oil content of 5-6 per cent. The group of 4 individuals with 7-9 per cent had a low ether

content, varying from 42 to 52 per cent; this is nevertheless regarded as quite satisfactory, and there is no reason to believe that high quality and oil content are incompatible. A study was made of the multicellular glands on the calyx, by mounting in methylene blue after decoloration with lactic acid. The observations shewed that the different strains are characterized by different numbers of glands, and that those with the greatest number of glands also have the highest oil contents. The results are tabulated.

The observations are made only on the calyx lobes facing the light, which contain a greater number of glands and only the middle flowers of the inflorescence are examined. The examinations are made before the flower opens, a very material advantage in genetical work, as it enables selections to be made before the time of crossing or selfing. Moreover as many as 70-80 plants can be examined by one worker in a working day of 10 hours.

Experiments are now being made on a method of determining the essential oil content of the glands by means of microstaining.

OIL PLANTS 633.85

230. ERMAKOV, A. I.

633.85:665.3:578.081

(A contribution to the methodics of breeding for quality [in oil seeds].)

Bull. Appl. Bot. Leningrad 1934 : Ser. 3 (5) : 33-71.

The success of breeding oil plants depends very largely on the possession of methods capable of estimating the oil content in a single seed or a part of a seed, since many lines which are morphologically uniform display great variations from the point of view of biochemical characters. Two such methods are here described, the first consisting of a modification of the Soxhlet extraction method suitable for a seed weighing not less than 0.20 g. and with an oil content of not less than 20 per cent. The second method consists of oxidising the oil with an oxidising mixture and estimating the remainder of the mixture iodometrically with a micro-burette. It is suitable for material weighing from 2 to 25 mg. During a month of twenty-four working days two workers each carry out 150 complete analyses.

Analyses were made by the method described to determine the oil content of groundnut, linseed and other seeds. Clear differences, in excess of the experimental error, were detected between the seeds; these may be modificational, but may equally well be due to hereditary differences between the seeds. Estimations were also made on the different halves of groundnut seeds to test their variation in oil content; the oil content of the different halves proved to be the same and the variation from seed to seed within a pod was very slight, except when they were attacked by fungi. In selecting groundnut it is therefore possible to use the indirect method of estimation, by determining the oil in one seed, sowing the adjacent one and so on all along the pod. The variation from seed to seed within the pod in lentils was also very slight, whereas in linseed different capsules were characterized by different oil contents and the seeds within a capsule also varied distinctly, from 37.1 to 46 per cent in one experiment and from 46.3 to 54.1 in the other. The seeds from the same locale differ only very slightly, being developed under identical conditions and this is the only means of selecting indirectly in linseed, estimating the quality of a seed required for sowing by analysing the oil in another seed from the same locale.

In sunflower very little difference was detected between sections taken from different positions on the seed and as seeds from which sections have been taken germinate satisfactorily it is possible to estimate the oil content in this case on the seeds actually used for sowing. Wide differences between seeds were observed, amounting in some cases to up to 100 per cent. A curve is given of the oil contents of the seeds in a supposedly pure line of sunflower, which clearly demonstrates the heterogeneity of the material with respect to oil content, the average being 48.34 ± 1.07 and the mean square deviation 7.0. There appear to be three different types with average oil contents corresponding with the three peaks of the curve; the curve is probably constituted from the overlapping of a number of different curves each corresponding to a different biotype. This is supported by the fact that the seeds with extreme oil contents are often absent in the analyses where only a small quantity of material was taken. However the point can only be decided by sowing the material with the extreme figures and analysing the progeny. There is no question, however, that these new methods are capable of detecting chemical differences within a botanically pure line and it is on these differences that future breeding work will be based.

231. NOHARA, S. 633.853.74:581.162:576.354.4
633.853.74:581.3
Gametogenesis and embryogeny of *Sesamum indicum* L.
J. Coll. Agric. Tokyo 1934: 13: 9-25.

Microsporogenesis, the formation of the embryo sac, fertilization and the formation of the embryo are described. The formation of the embryo sac follows the normal course and the irregularities found in *Trapsella* do not occur in *Sesamum*. The course of meiosis in the pollen mother cell also follows the normal course, there being 13 bivalents formed; the chromosomes do not differ noticeably in size or shape and are the same in ovules and anthers. Fertilization follows within 12 hours of pollination and embryo formation begins 24 to 30 hours after pollination, and after about 40 hours the embryo consists of a few cells carried up to the antipodal end on a long suspensor.

232. K-SKII, A. 633.854.78-2.51.521.6
(**Sunflower resistant to *Orobanche*.**)
Semenovodstvo (Seed Growing) 1935: No. 5: 41-44.

By growing the new sunflower strains resistant to the virulent race B of *Orobanche*, yields of 14.2 centners per ha. have been obtained as compared with 3.1 and 2.4 centners for the standard varieties Kruglik A/41 and Saratov 169. Five such resistant strains have been selected by the Rostov station and breeding work upon them is still in progress. Yield figures for a number of collective farms confirm the superiority of the resistant strains, which also proved equal in oil content to Kruglik A/41, one of the best varieties in this respect. All efforts are now being concentrated on the rapid multiplication of the new strains.

233. BEKETOWSKIJ, D. N. 633.879:575.127.2
633.879:581.162
[**The reproductive biology of the yellow acacia; the common form (*Caragana arborescens* Lam.) and the weeping form (*C. arborescens* Lam. var. *pendula* hort.)**]
J. Bot. URSS. 1934: 19: 434-46.

Seeds were taken in 1927 from a weeping form and 36 seedlings were obtained, none of which in 1932 shewed any sign of the weeping habit, evidently owing to cross-pollination from adjacent normal forms. To test this explanation reciprocal crosses were made in 1933 between the two forms.

At the same time 33 flowers of the weeping form were enclosed in one isolator and 21 flowers of the common form in another. Only two flowers set in each, shewing that natural pollination from neighbouring flowers is very rare; it is thought probable that these two flowers had set by self-pollination, though no self-pollination was observed when flowers were bagged alone. The application of spores of *Lycopodium* to emasculated flowers caused the development of 3.3 per cent of parthenocarpic fruits.

In the crosses, the number of fruits developing on the weeping form amounted to only 2 from 30 flowers crossed and on the common form 3 from 31 flowers, representing percentages of 6.6 and 9.6 per cent respectively. The seeds are being sown to produce the F_1 generation. The best medium for artificial germination of the pollen was a 10 per cent sugar solution. The pollen of the weeping form germinated as well as or slightly better than the common form and hence inter-pollination between these forms is to be expected in nature. The absence of weeping forms in the above seedlings would thus appear to indicate that this character is recessive.

The vegetative activity of the weeping form is less than the common form and it bears a much smaller quantity of fruit.

MEDICINAL PLANTS 633.88

234. KREIER, G. K. 633.885.1:575(47)
(Methods of establishing the cultivation of *Cinchona* in the U.S.S.R.)
 Bull. Appl. Bot. Leningrad 1934 : Ser.A (13) : 75-86.

The difficulties confronting the successful introduction of *Cinchona* into the Soviet subtropics are discussed in their various aspects. One of the most promising methods of overcoming the low cold resistance of the plant is to grow it as an annual or biennial from seed, utilizing the leaves and young growth for quinine extraction. Large numbers of seedlings have been grown with this object in view, selecting the seedlings primarily for viability in the Soviet subtropical conditions. In further selection alkaloid content, drought resistance and rapidity of growth will also receive attention, the object being to produce a young plant which in these dry summers will at the age of 1-2 years yield 1 gm. of quinine. A collection of *C. calisaya*, together with a few other species, brought from South America, forms the basis of this work. Clear differences in vigour of growth have already been observed and the best plants are being multiplied vegetatively in order to carry out chemical analyses.

RUBBER PLANTS 633.9

235. KRAYEVOY, S. 633.913:576.312.34
(Concerning the question of chromosome variation in *Scorzonera tau-saghyz* L. et B.)
 J. Bot. URSS. 1934 : 19 : 367-75.

Root tips were fixed by Levitsky's special chondriosome fixative, which revealed a diploid chromosome number of 14, each pair having clear morphological distinctions, which are described and illustrated. A second plant was examined and although the chromosome number was the same the types of the chromosomes were all entirely different. This illustrates the polymorphic nature of the species and shews the necessity for further careful study of its varieties and their systematics.

236. 633.913:576.356.4
 KRAJEVOJ, S. J. 635.166:576.356.4
(Trisomics and heterochromosomes in *Scorzonera nervosa* Trevis.)
 C.R. Acad. Sci. URSS. 1934 : 4 : 224-27.

The species normally had 6 pairs of chromosomes ($2n = 12$), the morphology of each of which is distinct and serves as a means of identifying them. The roots of certain plants contained 13 chromosomes in a certain number of the cells, in a proportion calculated as about 17 per cent. The size and behaviour of the extra chromosome shewed it always to be connected with the smallest chromosome pair, pair 6, which in normal individuals was always heterogeneous, one member of the pair being without a satellite. The extra chromosome was also without the satellite.

Trisomics have been observed also in *Scorzonera Tau-saghyz*, in the proportion of 2 per cent but not in other species examined. Their origin is thought to be due to somatic non-disjunction or chromosome elimination.

No karyotype with two similar chromosomes of the sixth pair, with or without satellites, has been observed and the homozygous combination is therefore thought to be non-viable.

237. 633.913:581.162
 DIANOVA, V. I., SOSNOVETZ, A. A. and STESCHINA, N. A. 633.913:576.354.4
(Comparative cyto-embryological investigations on varieties of *Parthenium argentatum* Gray and *P. incanum* Gray.)
 J. Bot. URSS. 1934 : 19 : 447-66.

A study was made on pollen development in a number of varieties of both species. The haploid number 36 was generally observed but it was not uncommon to find higher numbers. Various irregularities of division were also noted, leading in some cases to the formation of irregular

tetrad and pollen grains ; some of the latter had more than two nuclei and were often gigantic. They were sometimes capable of germinating and produced more than two sperm cells. The normal pollen retains its viability for 30 days and over. In *P. argentatum* the pollen germinates more readily on cross-pollinating than on self-pollinating, indicating a tendency on the part of guayule to cross-pollination. Sterile pollen was encountered in all varieties, the actual percentages being different in the different varieties.

The embryo sac development was also examined, leading to the conclusion that double fertilization occurs in the ordinary way, though phenomena of degeneration and sterility were observed here also. No parthogenesis was observed after emasculation and isolation.

238. PODDUBNAJA-ARNOLDI, W. STESCHINA, N. and 633.913:581.162.5:576.356
SOSNOWETS, A 633.913:583
(On the biology of flowering and reproduction in *Scorzonera tau-saghyz*
Lipsch. et Bosse.)
J. Bot. URSS. 1934 : 19 : 338-66.

The Russian version of the article reviewed in " Plant Breeding Abstracts," Vol. V, Abst. 1097.

FRUIT TREES 634

239. RIEBESEL, G. 634-1.541.41
Vegetative Vermehrung von Obstgehölzen. (Vegetative propagation of
fruit tree cuttings.)
Züchter 1935 : 7 : 156-59.

A method which has proved successful for the propagation of fruit tree cuttings by means of grafting on to root stocks of suitable varieties is described. The method has been patented and no researches by the method may be undertaken without the permission of the author.

240. NEBEL, B. R. and KERTESZ, Z. I. 634.11:575.182
Metaxenia and xenia in apples. IV.
Gartenbauwiss. 1934 : 9 : 45-64.

Evidence for metaxenia is presented from the results of crosses made in 1930-1933 of Fameuse with Yellow Bellflower and McIntosh, and of McIntosh with Yellow Bellflower, Red Astrachan, *Malus baccata* and *M. atrosanguinea*. The results previously recorded (see " Plant Breeding Abstracts," Vol. II, Abst. 686), are confirmed. Data are given shewing the effect of metaxenia on size and uniformity of the fruit and also on the acidity and pH of the sap. Loss of weight under storage conditions appeared to be a metaxenial character as did also the correlation co-efficient of seed number and fruit size. Xenia was observed with regard to seed length and variability of seed length.

The theoretical aspects of the problem are discussed and it is considered that patroclinal effects are more likely in the case of general, complex characters but not where specific, simple characters are concerned.

241. DEGMAN, E. S. and AUCHTER, E. C. 634.11:575.183
Metaxenia studies with apples.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 213-20.

Experiments were undertaken to ascertain whether metaxenia (direct effect of pollen on parts of the seed and fruit lying outside the embryo and endosperm) occurred in the apple, using 4 varieties as female parents and 5 as male parents and keeping number of leaves per apple and number of apples per spur constant.

By inspection it was found impossible to tell the pollen parents of the resulting fruits. Differences in weight of fruit were found, but the same pollen parent did not always give the heaviest fruits, and moreover, a certain amount of the differences could be attributed to differences in number of seeds. It was concluded therefore that there was little if any metaxenial effect of the different pollens in this respect. Variations in acidity and total sugar content were not connected with the pollen parent.

242. EINSET, O. 634.11:575.252:581.162.5
Cross-pollination trials with bud mutations of the apple.
 Gartenbauwiss. 1934 : 9 : 157-58.
 Pollinations were made between a number of bud mutations and their parental varieties, the following combinations being made :—Ben Davis and Black Ben Davis ; Duchess, Van Buren red Duchess, Daniels red Duchess ; Twenty Ounce and a red-fruited Twenty Ounce ; and a solid red McIntosh, a striped-red McIntosh and McIntosh.
 All combinations proved sterile with the exception of those of Van Buren Duchess which with either of the Duchess strains gave a full set of fruit. The Van Buren also differs from the original variety in other factors than colour. It is thus considered as a mutant of a different type from the others and is the first instance of a red sport differing also in compatibility relations towards the variety from which it arose. It can thus be used as a pollinator in pure plantations of the Duchess variety.
243. EVREINOFF, V. A. 634.11:576.16
Malus pumila Mill., f. *apetala* (Münchh.)
 Rev. Hort. Paris 1935 : 107 : 369-71.
 A description of *Malus pumila* Mill., f. *apetala* and its fruit. Its possible relationship to the cultivated varieties of apple is mentioned.
244. 634.11:576.16:575.12
 634.11-2-1.521.6
 634.11:575.11
 SEELIGER, R.
 Beobachtungen an *Malus*-Arten I. (Observations on *Malus* species I.)
 Mitt. dtsch. dendrol. Ges. 1934 : No. 46 : 1-22.
 A description and identification of the representatives of the *Malus* species and hybrids contained in the arboretum of the Biologische Reichsanstalt für Land- und Forstwirtschaft at Naumburg a. S. Special attention is paid to the constitution of the hybrid forms and the value of certain morphological and physiological characteristics in the identification of hybrids is mentioned.
 In a cross made by the writer, namely *M. communis* subsp. *pumila* (with adherent calyx) x *M. baccata genuina* (with deciduous calyx) 3 types of fruit trees were obtained in the F₁, some with adherent calyx, some with a deciduous calyx and some a calyx easily detached by a touch. Whether the latter at a later stage correspond actually with the deciduous group needs further investigation.
 Observations on resistance to certain fungous and insect pests are stated to be in progress. Full details are to be published elsewhere.
 A summary of the observations recorded in this paper, a survey of species and a diagnostic key are to form the substance of a further report.
245. LANTZ, H. L. and BOLE, S. J. 634.11:581.41:575.11
Apple breeding : inheritance of tree shape in apple progenies.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 256-60.
 In the autumn of 1929 the height and spread of some 5,000 crossbred apple seedlings from 55 different crosses, set in 1924 were measured. The shape index was determined according to the formula $I = (H-2)/D$ where I = shape index, H = height of tree in feet and D = diameter of spread in feet. The trees were divided into the classes : spreading ($I = 0.51-0.80$), round ($I = 0.81-1.20$), upright-spreading ($I = 1.21-1.60$) and upright ($I = 1.61$ or over).
 Analysis of the mean indices of the various progenies shewed that shape is probably determined by multiple factors, and that round shape is partially dominant. Thus in the progeny of Delicious ($I = 1.12$) crossed with 15 other parents, 52.3 per cent fell in the round class.
246. NEBEL, B. R. 634.11:581.49:576.356.5
Characteristics of diploid and triploid apple varieties I: measurements of stomata.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 254-55.
 The extent to which triploid varieties occur among cultivated apples indicates that they possess some value, which ought to be traceable, and the co-operation of other workers is requested. Measurements of stomata have shewn that those of triploids are consistently about 10 per cent longer than those of diploids, though variations due to cultural conditions are also found.

247. 634.13 Gorham
634.13:575(77.1)
HOWLETT, F. S.
The Gorham pear.
Bi-m. Bull. Ohio Agric. Exp. Sta. 1935 : 20 (173) : 90-92.

An interim report on the characteristics of the Gorham pear now undergoing trials. As it is of high quality, ripens two weeks later than Bartlett and is a satisfactory pollinator of the latter, Gorham is suggested for use in new plantations of Bartlett.

248. 634.13:576.312.35
634.13:576.356.5:576.354.4
ITO, H. and FUKUSHIMA, E.
Ueber die Chromosomenzahl der japanischen Birnsorten (*Pyrus serotina* Rehder). [**On the chromosome number of the Japanese varieties of pear (*P. serotina* Rehder).**]
Proc. Imp. Acad. Tokyo 1934 : 10 : 665-67.

Chromosome counts have been made of 57 varieties of Japanese pear, mostly belonging to *P. serotina*, and of 13 F_1 hybrids between *P. communis* and *P. serotina*. Two varieties, Tosanisiki and Sinyôzyûrô proved to be tetraploid with 68 chromosomes, the rest were all diploid with $2n = 34$. Contrary to the European pears, no triploids were found; tetraploids on the other hand do not appear among the European pears.

In the diploids 17 bivalents were formed regularly at meiosis, which was perfectly regular. Large numbers of bivalents appeared also in the tetraploids but a certain number of quadrivalents were also observed, their number varying from 8 to 13. Meiosis was comparatively regular. The crosses between the diploid and tetraploid forms were as successful as crosses within the diploids and these tetraploid varieties are thought to have a promising future in pear breeding.

249. 634.22:575
ALDERMAN, W. H. and ANGELO, E.
An analysis of the breeding value of certain plum varieties.
Proc. Amer. Soc. Hort. Sci (1934) 1935 : 32 : 351-56.

A list of 85 different parental combinations is given from which 2,980 seedlings have fruited. One hundred and thirty-eight have been selected as *fair*, *good* or *superior*, representing 41 combinations. Only 31 were rated as *superior*, representing 14 combinations, 23 of these seedlings having Burbank as one parent and 10 appearing in a Burbank x Kaga cross. In general, it seems necessary for at least one parent to have a *superior* rating. More seedlings worthy of selection were obtained from F_1 or backcross populations than from F_2 , possibly because larger populations would have been needed in the latter case. Crosses of *P. salicina* (Asiatic) by American species were much more productive of seedlings worth selecting than crosses among American species. The Japanese species introduces valuable fruit characters such as size, firmness of flesh, adherence of stem and distinctive flavour; it is better used as female parent, as it gives only one third of the proportion of valuable seedlings when used as the male parent.

The chances of obtaining valuable forms from open-pollinated seed are not very good unless large numbers are grown.

250. 634.22:576.16
634.22-1.524.2:575.127
KOVALEV, N. V.
(The myrobalan plum, *Prunus cerasifera* Ehrh.)
Bull. Appl. Bot. Leningrad 1934 : Ser.A (13) : 95-103.

The myrobalan plum is of interest from two important points of view, firstly its frost resistance, and secondly its supposed role in the origin of the cultivated plum *P. domestica*, recently substantiated experimentally by Rybin. Descriptions are given of the species, including some recently discovered and unusual specimens of it. The Soviet expeditions have disclosed an unsuspected range of variation in the species, both morphological and ecological, and have made it possible to study the geographical distribution of the characters, the greatest concentration of which is in the Caspian coast of Daghestan. Here the dominant black fruited forms are concentrated, the purple and red being found in the central and southern Black Sea coast and the recessive yellow forms in the periphery of the area, in West and East Transcaucasia and the

north coast of the Black Sea. In the centre of distribution fruits varying in transverse diameter from 17 to 37 mm. are found, with stones contributing from 6 to 11 per cent of the total weight of the fruit, of shapes varying from extremely elongated to almost round, and of almost all colours. The species is found at varying altitudes, up to 1,800 m. and several different biotypes, or even varieties, evidently exist, adapted to widely different types of climate and growth conditions. Differences of two weeks between forms are observed in respect of flowering and one and a half months in respect of ripening. Forms with free and clinging stones exist and there is a similar diversity in vegetative characters.

The classification of the genus *Prunus* according to Rehder is reproduced and is seen to be confirmed by the cytological data. Many interspecific hybrids of *P. cerasifera* have been observed in nature; e.g. a new form from Fergana has been identified as a hybrid between *P. cerasifera* and *Amygdalus ulmifolia* (Franchet) M. Pop. and innumerable such hybrids have been found in the zone where the areas of the two species overlap, most of them being intermediate in character between the two parents. To *P. dasycarpa* has been ascribed a similar origin. As many as 800 hybrids of *P. cerasifera* with *P. spinosa* have been observed and the chromosome number 24 has been established for a number of these by Rybin; the hybrids are almost completely sterile. Other hybrids are possessed of a higher degree of fertility and among the wide range of forms of *P. cerasifera* it ought to be possible to choose a number that will be of value in breeding. By crossing with the apricot, the peach and the southern plums it is hoped for instance to create more cold-resistant forms of these fruits suitable for northern zones. Crosses with other allied species are going to be made in the attempt to elucidate the interrelationships of the species and especially the origin of the domestic plum. One of the natural hybrids of *P. cerasifera* x *P. spinosa* examined by Rybin had the double chromosome number $2n = 48$ and was in all morphological characters indistinguishable from the common plum. It is important that similar studies should be made with the allied species such as *P. ursina*, *P. cocomilia*, *P. monticola*, etc. At least 15 different forms of cultivated myrobalan have been found in the areas of its wild distribution, where indeed all degrees between the wild and cultivated states can be observed. The fruits of the cultivated forms vary from 37 to 43 mm. in size and many of them are of excellent flavour, have free stones and are suitable for transport. Analysis shews them to contain more sugar and less acidity than the wild forms and many of them are worthy of direct introduction.

251. GARDNER, V. R.

634.23-2.111-1.557:575.252

A study of some unproductive sports of the Montmorency cherry.

J. Agric. Res. 1935: 50: 457-78.

Field observations in commercial Montmorency cherry orchards have brought to light a number of sports which give yields ranging from substantial reductions from the normal to an almost completely barren condition.

The sports are usually limb sports, but some were whole trees, probably resulting from the propagation of limb sports. The sports are classified thus:—(1) Those failing to form any flower-buds on the fruiting spurs; (2) those forming leaf buds where flower buds are normally formed; (3) those shewing marked susceptibility of flower buds to low temperature while in a dormant condition (winter-killing); (4) those shewing marked susceptibility of flower buds to injury from less severe temperatures while in delayed dormant or early post-dormant condition; (5) those shewing marked susceptibility of flower buds or opening flowers to spring frost; (6) those characterized by poor fruit setting. Sports often had their yield adversely affected by more than one such cause. The most important from a commercial standpoint are those due to poor fruit setting and those producing light yields, the latter because they are more likely to escape notice than barren sports.

252.

BLAKE, M. A.

634.25-2.111

634.25 Polly

Some facts about the new peach known as "Polly."

N.J. Hort. Soc. News 1935: 16: pages 718 and 733.

"Polly," a winter-hardy, freestone, white-fleshed peach introduced by the pomology subsection of the Iowa station, has been somewhat less successful at New Brunswick.

253. CULLINAN, F. P. and WEINBERGER, J. H. 634.25-2.111-1.521.6
Studies on the resistance of peach buds to injury at low temperatures.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 244-51.

Measurements made on cut shoots in a thermostatically controlled refrigerator shewed that in addition to varietal differences, resistance to cold was affected by seasonal conditions, stage of development of the bud and the qualitative and possibly quantitative conditions within the bud itself. Buds, for example, which have begun to develop in late winter, are more susceptible to subsequent low temperature than those still in their resting period, or again, those on trees low in nitrogen and where the shoot growth was short did not survive as well as those on the more vigorous trees.

254. BLAKE, M. A. 634.25-2.111-1.521.6:575(73)
Breeding for hardiness in peaches.
 N.J. Agric. 1935 : 17 : p.l.

A note on the commercial J. H. Hale and Elberta peaches and some of their crosses, all of which are defective in winter-hardiness.

Hardy new varieties bred from crosses made in 1914-20 are named. After the severe winter of 1933-34 rigid selection of varieties and seedlings for hardiness was carried out with a view to new crosses in 1935.

255. FRÉMONT, T. 634.3:582
 Etude sur quelques caractères botaniques et agronomiques du genre *Citrus*.
(Study on some botanic and agronomic characters of the genus *Citrus*.)
 Rev. Bot. Appl. 1935 : 15 : 235-42.

The cultural zones of the genus are enumerated. The confusion in the taxonomy of this genus is attributed not only to the numerous environmental variations due to the very wide area of cultivation of the *Citrus* group, but also to the great antiquity of its cultivation accompanied by selection and the preservation of numerous species and above all to the phenomena of polyembryony, bud mutation and spontaneous hybridization.

After a brief examination of the classifications adopted by Linnaeus, Marcovitch and Swingle the botanical and horticultural characteristics of the principal forms of *Citrus* are stated, with an indication of their economic importance.

A bibliography concludes the paper.

256. 634.31 Robertson Navel
 SHAMEL, A. D. and POMEROY, C. S. 634.31:575.252
The Robertson strain of the Washington Navel orange.
 J. Hered. 1935 : 26 : 218-22.

The Robertson strain of the Washington Navel orange arose as a limb sport. Its characteristics are more rapid growth of the young fruits, enabling them to escape the so-called "June drop," heavy production, early maturity, very smooth texture of the rinds and, in some cases, the development of rather large navels. The strain retains its characters when propagated by budding, and its relatively short, pendent vegetative growth gives the trees a somewhat dwarf or drooping appearance. The mature fruits are quite similar to Washington Navel in colour of flesh, amount of rag, tenderness, flavour of juice and size.

257. VELARDEZ, J. G. 634.31:575.42(81)
 La naranja criolla puede ser base para la formación de tipos selectos. **(The local orange can form the basis for the production of selected types.)**
 An. Soc. Rur. Argent. 1934 : 68 : 201-02, 204.

Arguments are given which prove that the local orange is not inherently inferior to the oranges of other countries in size, flavour, appearance or yield, and by careful selection types should be produced which equal or surpass the best imported varieties. Promising selected varieties are already available in Corrientes, viz. Mejorada del Riachuelo and Cáscara Pálida, and in Tucumán, viz. Simoca and Tortella ; the selection Campo Santo is already well known in Salta.

258. MONIUSZKO, V. A. 634.462
 [The carob tree and the possibility of its cultivation in U.S.S.R. (*Cer-
 atonia Siliqua* L.).]
 Suppl. 63 Bull. Appl. Bot. Leningrad 1934 : Pp. 128.

The monograph begins with a discussion of the systematic position of the species *Ceratonia Siliqua* and a botanical description of the tree and its various organs; its geographical distribution, cultivated and wild, the biology of flowering and reproduction, the origin of the different sex forms, and the early study of the species are treated in full. The ecological conditions required by the plant and the possibility of its cultivation in the Soviet Union are then discussed, as a result of which the most suitable localities are indicated. A further chapter is devoted to the history of cultivation of the carob, and the methods of cultivation, including the measures of assuring adequate pollination, are described. Considerable variation exists in the form of the fruits, seeds, etc., and in other characters and descriptions are given of the few botanical varieties that have been definitely established, with indications of the characteristics of the forms examined from a number of different countries where the carob is grown. The fairly wide morphological and ecological variation observed in the species makes it probable that by mass introduction some forms suitable for cultivation in the U.S.S.R. will be found.

259. NIXON, R. W. 634.62:575.183
Metaxenia in dates.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 221-26.

The pollen of the date palm as already reported ("Plant Breeding Abstracts," Vol. III, Abst. 507) has an effect not only on the seed but on the fruit. Thus Mosque pollen produces a larger fruit and seed, ripening relatively late while Fard No. 4 pollen produces a smaller fruit and seed ripening relatively early. Owing to the heavy production of the date palm, necessitating thinning of the bunches, the effect on size is not likely to find a commercial application, but the more marked effect on time of ripening (15 days at the beginning of the season and more towards the end) has already been utilized successfully on a ranch which had had trouble with delayed ripening.

260. BRYAN, W. E. 634.62:577.845
A monoecious date palm.
 J. Hered. 1935 : 26 : p. 146.

A record of a male date palm producing fruits with seeds.

261. ROZANOVA, M. A. 634.71:575.129:576.16
 634.71:575.127.2:576.356.5
(Modes of form genesis in the genus *Rubus*).
 J. Bot. URSS. 1934 : 19 : 376-84.

Crosses were made between two species at the limit of crossability within the genus, namely *R. caesius* (section *Eubatus*, $2n = 28$) and *R. idaeus* (section *Idaeobatus*, $2n = 14$). The cross succeeded only when *R. idaeus* was used as female parent. Five hybrids were obtained from the first cross made, the hybrids differing from one another morphologically but all showing more resemblance to *R. caesius*. Only one flowered and bore fruit and this on cytological examination proved to be a tetraploid, evidently resulting from the fertilization of an unreduced egg by a normal pollen grain. In a second cross all the hybrids were similar and flowered abundantly but were sterile, being all triploids. From all the flowers only six seeds were formed, from which three seedlings have now been obtained. These are developing normally and have proved to be hexaploid with $2n = 42$, the most probable explanation of which is that they have been formed from the union of two unreduced gametes, a phenomenon which is thus seen to be somewhat frequent in the genus *Rubus*.

These 28 and 42 chromosome forms correspond in almost every respect to the species constituting the series *Sub-Idaei* and there is every probability that this series has arisen in a similar way by hybridization and chromosome duplication. In support of this view mention is made of a fertile pentaploid plant found in nature in the near vicinity of bushes of both *R. caesius* and *R. idaeus*. Such processes have evidently played, and are still playing, a large part in the evolution of the genus.

262.

ROZANOVA, M.

634.71:581.9:575.22

634.75:581.9:575.22

(Contribution to the question of geographical and ecological variation of characters as shown in the instances of several representatives of the genera *Rubus* and *Fragaria*.)

Bull. Appl. Bot. Leningrad 1934 : Ser. 8 (2) : 35-85.

The object being to study the geographical variability of the three characters size of fruit (length and breadth), pubescence, and spines, observations were made of four species of *Rubus*, namely *R. idaeus*, *R. saxatilis*, *R. arcticus* and *R. caesius*, and two species of *Fragaria*, *F. vesca* and *F. elatior*, 94 specimens from different localities being examined in all; the observations were made on the material grown in the vicinity of Leningrad. The average data for all three characters are tabulated. They shew that in *R. caesius* the size of fruit varies very little according to either the ecological or geographical position of the locality, the largest fruits occurring sporadically in all different localities; in the other species there was a fairly marked tendency for large fruits to occur in the Caucasus. Examinations of the progeny of the forms of different sizes shewed them to be hereditarily constant.

Similarly the degree of spininess and pubescence varied considerably within each geographical group and the characters shewed no regular geographical distribution in *R. caesius* and *R. arcticus* or *Fragaria*; in *R. saxatilis* and *R. idaeus* there was a slight increase of spininess and pubescence towards the east, both being more pronounced in the Caucasus, and more still in the far east. The different degrees of spininess also proved to be hereditarily constant.

The greatest similarity in manner of variation of the characters was observed between *R. idaeus* and *R. saxatilis* and between *R. arcticus* and *R. caesius*. This in no way corresponds to the systematic or genetical relationship between the species. The same amount of variation in spininess was observed in the cultivated and wild varieties of *R. idaeus*, indicating that selection has not been practised for this character.

Exceptions were noted to all the geographical tendencies mentioned, and these are susceptible of various types of explanations.

263.

SCHWARTZE, C. D.

634.711.3 Lloyd George : 575

Further observations upon the Lloyd George red raspberry as a parent in breeding.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 411-15.

Observations on a number of red raspberry crosses have indicated the high value of the Lloyd George raspberry as a parent in respect of shape, size and flavour of fruit, number of seedlings worthy of selection and hardiness, particularly in combination with Cuthbert and Latham. The object in view has been to produce a hardy variety with the qualities of Cuthbert in respect of canning, flavour, freezing and fresh shipment. Selections were usually made during the second fruiting season of the hybrids rather than the first.

264.

SLATE, G. L.

634.711.3:575(73)

The best parents in red raspberry breeding.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 407-10.

The relative value of a number of raspberry varieties for breeding purposes is estimated from the number of promising seedlings produced from crosses in which they participate. The results of selling do not form a satisfactory criterion owing to the number of weakly plants obtained. The results of 80 crosses, involving 30 varieties are shewn diagrammatically. Lloyd George has proved to be one of the most valuable parents in red raspberry breeding, especially in combination with Newman and with Newburgh. Other varieties which have been useful include Loudon, Herbert (in combination with Newman), June and Marlboro (for introducing earliness and a bright fruit colour) and Cuthbert (for introducing canning qualities).

In general the method of varietal crosses is the most promising line of attack on the problem of red raspberry improvement.

265. PAVLOVA, N. M. 634.72
(The gooseberry.)

Lenin Acad. Agric. Sci., Inst. Pl. Ind., Sci. Pop. Ser. 1935 : No. 53 : Pp. 120.

After tracing the history of gooseberry cultivation from its first mention in France in 1536 to the present day, and an account of its present importance in different countries, a botanical description is given of the genus and its various species, with indications of its geographical distribution in the wild state and a key to the species and hybrids. The several characters used in distinguishing the different species and forms are discussed, with special reference to their constancy and their value in classifying the commercial varieties. The classifications of earlier botanists are discussed and a key is given for the determination of the 36 best commercial varieties. Full descriptions are given of a large number of varieties; their origin, when known, and their Russian, English, German and occasionally French names are indicated. Their behaviour as regards *Sphaerotheca* and other ailments is also discussed.

A chapter is devoted to breeding, starting with indications of the requirements in regard to the new varieties for growing on the large scale of modern Soviet agriculture. The production of varieties suited to the different regions and varieties resistant to *Sphaerotheca* are also urgent desiderata. The results of earlier breeders are outlined, including reference to the successes achieved by Spirin, Michurin and others in the Soviet Union, largely by the use of American species for crossing with the European gooseberry, whereby *Sphaerotheca* resistance and other valuable qualities have been introduced. Interspecific crossing is recommended as the most promising method of breeding and the most suitable species for various purposes are tabulated. The diseases and pests of the gooseberry are touched upon, together with a number of more general questions, and a bibliography of 20 references is appended.

266. PAVLOVA, N. M. 634.722

(Classification of the species of red currant on a genetical basis.)

Bull. Appl. Bot. Leningrad 1934 : Ser. 8 (2) : 87-119.

The literature on the classification on the varieties of the red currant and of the species which have contributed to their origin is reviewed in great detail. The author's own results are then presented, based on the study of the vegetative, floral and fruit characters in 50 varieties. Certain of these characters have proved capable of distinguishing the three main species and their descendants, *Ribes vulgare*, *R. rubrum* and *R. petraeum*. The characters can be detected in the hybrids of the respective species and by their aid it has been possible to assign a probable ancestry to the varieties and establish a natural classification of them according to their genetical relationships. The varieties are arranged in eight groups according to the different combinations of species constituting their parentage and a key to the determination of 37 of them is given, together with a table of the synonyms under which the several varieties have been received.

267. COLBY, A. S. 634.727-2.481-1.521:6:575

Inheritance of gooseberry leaf infection.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 397-99.

From studies of the amounts of infection in certain progenies from crosses and selfings, it was deduced that Transparent, Rideau and Como carry factors for resistance to anthracnose and leaf spot, while Poorman, Glennedale, Oregon Champion, Downing and Minnesota No. 96 appear least promising from this point of view. Several seedlings were obtained which were high in resistance and of value from the standpoint of spinelessness and production of large fruit.

268. CLARK, J. H. 634.75:575"793"

Breeding strawberries for a particular ripening season.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 416-19.

With a view to producing a late ripening strawberry for New Jersey, numerous crosses have been made and the time of ripening of the progeny noted and compared with that of the parents. In general the average time of ripening of the seedlings was intermediate with respect to the parents, with a range usually extending beyond the range of the two parents. Some varieties apparently transmit late ripening to a different extent in different combinations. Certain varieties are listed according to their tendency to produce seedlings ripening at a particular season.

269. GRANER, E. A. 634.771:576.312.35
 Observações sobre o numero de cromosomios na bananeira. II. (**Observations on the chromosome number of the banana. II.**)
 Rev. Agric. S. Paulo 1935 : 10 : 149-51.

In continuation of the earlier study (see "Plant Breeding Abstracts," Vol. V, Abst. 790), details are presented of root tip examinations of three further Brazilian varieties all belonging to the species *Musa sapientum* L. The number 33 was established for the varieties Macã and Figo and 22 for Ouro. All three are edible and even the diploid variety contains no seeds.

270. NEGRUL, A. M. 634.835:581.163
 (**Contribution to the question as to parthenocarpy and apomixis in the grape.**)

Bull. Appl. Bot. Leningrad 1934 : Ser. 8 (2) : 229-68.

In discussing the "false hybrids" obtained by many investigators in vines reference is made to crosses at the Ukrainian Institute of Viticulture of Kopchak and Plavay ♀ with Rupestris du Lot ♂. The F₁ plants were of two types, namely American types shewing clear variation in morphological characters, and European types which were all more or less identical and similar to the European parent. Although the latter group may have arisen by self-pollination it is thought more probable, in view of their extreme uniformity, that they are the result of apomictic development of the egg cell. A similar apomictic development is a possible explanation also of the matroclinous hybrids of Millardet and the seeds formed from the female flowers of certain varieties on self-pollination, the literature of which is discussed.

The experiments here described were made on a number of varieties, some with hermaphrodite and some with female flowers. To test the possibility of seed development in the absence of fertilization six hermaphrodite varieties were emasculated and bagged ; two varieties, Aligoté and Plavay, formed fruits with seeds : 50 per cent of the fruits in the first variety were seedless and 81 per cent of the seeds formed (119 in all) were small and ill-developed, and only 5 (\pm 4 per cent) germinated ; in Plavay 57 per cent of the fruits were seedless but all the seeds formed were well developed and the germination percentage was 41. One variety formed parthenocarpic fruits without seeds and others gave no fruits at all. The viable seeds in the first mentioned varieties are however unquestionably the result of apomixis.

Detailed examinations were made on the "female" varieties in 1929 and 1930. The pollen was different morphologically from that of the hermaphrodite varieties, was without pores and failed to germinate in all three years it was tried, a variety of different media being used. All varieties gave fruit with normal seeds on pollination with pollen from Rupestris du Lot, whilst selfing produced no result at all in 13 varieties, three varieties formed fruits without seed and 16 varieties produced fruit and also seed. After emasculation 27 varieties gave no fruit at all, one variety produced parthenocarpic fruit and three formed fruits with seeds, though the proportion of seedless fruits was different in the different varieties.

The seeds produced by selfing mostly failed to germinate : in many varieties they were empty, and only very few had normally developed endosperm and embryo, the highest proportion of such being found in Nimrang with 9 per cent ; some of the seeds from Nimrang and from Takvery germinated and one of the former had two embryos. Very few of the seeds formed after emasculation were normally developed, though odd seeds from the varieties Tagobi and Muscat d'Alexandrie contained an embryo as well as endosperm.

The varieties are classified according to their capacity to produce parthenocarpic fruits, from complete incapacity up to parthenocarpy with parthenospermy and apomictic embryo development, some without pollination, some only after the stimulus of pollination. The hermaphrodite varieties shew similar variations, from incapacity for parthenocarpic development up to obligatory parthenocarpy.

By these experiments the possibility of obtaining seeds apomictically and the necessity for excluding such varieties from genetic work have been demonstrated. The character of the pollen, the small size of the embryo and the occurrence of polyembryony are all grounds for believing that even the seeds formed from self-pollination in a variety such as Nimrang are apomictic

rather than the result of fertilization and certainly cannot be taken as indications of the viability of the pollen produced in such "female" varieties. The capacity to form parthenocarpic fruits is sometimes useful in cultivation, as it enables the plant to form fruits even when unfavourable weather conditions or other factors prevent adequate pollination being effected at the time of flowering.

271. WELLINGTON, R. 634.835-2.111-1.521.6:575

Winter injury to grape seedlings.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 389-91.

A report on the survival of various hybrid seedlings after the severe cold in the winter of 1933-34, at the Experimental Station, Geneva, New York. Forms derived from Worden, Moore Early and Concord Seedless shewed, among others, great hardiness. In general it is suggested that since *V. labrusca* is much harder than *V. vinifera* and *V. vulpina* varieties are also resistant, a combination of the *V. vulpina* and *V. labrusca* types should shew extreme hardiness.

272. BÖRNER, C. 634.836.72:575(43)

Beiträge zur Züchtung reblaus- und mehlaufester Reben. I. vorbemerkung.

(On the breeding of phylloxera and mildew resistant vines. I. Foreword.)

Mitt. Biol. Reichsanst. Berl. 1934 : 49 : 5-15.

BÖRNER, C. and SCHILDER, F. A.

II. Das verhalten der Blattreblaus zu den Reben des Naumburger Sortimentes.

(II. The behaviour of phylloxera towards the vines of the Naumburg collection.)

Mitt. Biol. Reichsanst. Berl. 1934 : 49 : 17-84.

The first section of this pamphlet deals with the aims in breeding for immunity in vines with special reference to Germany which is in great need of vigorous phylloxera resistant stocks for its vineyards. Complete immunity to the various biotypes of leaf phylloxera could, it is affirmed, be obtained by crossing partially immune types.

Numerous suggestions are put forward in regard to the problem of phylloxera biotypes to solve which the breeding of new immune stocks from crosses of American vines and *Vinifera* types is preferred in Germany to the attempts that have been made in other countries to utilize purely American crosses.

A method is suggested for the more rapid identification of stocks immune to root phylloxera, and for the selection technique in working with new forms as compared with American or American x *Vinifera* crosses.

Schemes for breeding both stocks and hybrids are tabulated. In referring to the plant material to be discussed in Part II of the paper stress is laid on the necessity of a knowledge of the reactions of wild vines to phylloxera.

The lines along which breeding for resistance to the fundatrix type should be attempted are outlined.

In Part II the importance of breeding stocks and hybrids immune to phylloxera in Germany having been made clear the collection of vines (mainly American and their crosses) at the Naumburg station of the Biologische Reichsanstalt is described. The methods of testing, including the infestation technique, the estimation of types of reaction and the mode of recording them are fully set out, accompanied by a series of tables of the vines in the collection, their sources and performance in the tests.

Complete immunity to phylloxera was found only in one *Vitis* variety, viz. *V. cinerea*. Immunity to all the 8 known biotypes of leaf phylloxera was also found in wild forms of *V. riparia*, *Berlandieri* and *rupestris*. All four should therefore be useful in breeding for complete immunity to leaf phylloxera; and the procedure that could be adopted with the last three American species from the material available at Naumburg is outlined. All other crosses of the material tested would be useless.

From the data for tested seedlings from varieties and crosses it would seem that the negative reactions observed are the expression of a special genotype and that the phylloxera biotypes are susceptible only to the particular hereditary factor that affects them individually. From this

it may be inferred that vines resistant to several biotypes carry several immunity factors which are probably not linked. Moreover the work with the American species indicates that resistance to the same biotype may be due to factors that are not identical in each species of the vines in question.

It was also noticed that diploidy or haploidy of these genetic resistant factors may produce similar or different effects on the immunity of certain varieties and hybrids.

Observations were taken on dominance or recessivity of resistance in various crosses and on the type of segregation, whether mono-, di- or tri-hybrid as the case might be.

A survey of the results of infection of promising varieties to be used for breeding is tabulated. It is concluded that only crosses comprising, in addition to *riparia* also *cinerea*, *Berlandieri* or *rupestris* augur success and the undesirable characters must be eliminated in subsequent generations.

The difficulties of breeding for fundatrix resistance are explained and the future outlook in this sphere briefly considered.

The value and use in large numbers of "indicator" vines (of known reaction to phylloxera) to identify existing or new biotypes are described; and the importance of such knowledge to the practical viticulturist is stressed.

A list of varieties with their identification numbers is appended with a number of illustrations of injury by phylloxera.

273.

634.836.75

634.835:575.11

634.835-2.42-1.521.6:575

NEGRUL, A. and BACHMAYER, I.

(Breeding vines resistant to mildew.)

Bull. Appl. Bot. Leningrad 1934: Ser. A (12): 23-35.

The results obtained in Germany and recently described by Husfeld (see "Plant Breeding Abstracts," Vol. III, Abst. 276 and V, Abst. 792) are first briefly reproduced, followed by certain results of the Ukrainian Institute of Viticulture. Amongst 298 F_2 seedlings of the cross Mourvèdre x *Rupestris* 1202 (of which the F_1 plants were all of the American type) 6 plants of the European type were observed.

In 1930 and 1932 observations were made on mildew attack, the whole nursery being very badly infected. In seedlings of the hybrids Gamay x *Riparia* 595, the correlation between the degree of attack in the two years was + 0.34, in the seedlings of Shaslja Rozovaja x *Rupestris* 4401, the correlation was + 0.26. The infection is therefore somewhat variable from year to year. Between mildew and phylloxera attack the following correlations were obtained in the 595, cross $r = -0.28$, in that of 4401 $r = -0.29$. In view of the negative correlation of these two desirable characters therefore it is important to make a closer study of the degree of linkage and the possible existence of crossing-over, etc.

Cytological observations have confirmed the number $n = 19$ for most of the species and hybrids examined. Two seedlings from selfing Mosel-Riesling (*V. vinifera*) had $2n = 40$ however and these were therefore crossed with *V. rotundifolia*, which also has $2n = 20$ and is completely resistant to phylloxera. The hybrids had $2n = 38$ and an entirely regular reduction division in both F_1 and F_2 .

Observations were made on 10,000 seedlings of Mourvèdre x *Rupestris* 1202, to study the segregation in an interspecific cross.

The autumn leaf coloration was monofactorial. The hybrid 4401 was double recessive rr and gave only yellow seedlings. The form of the shoot tips was dihybrid, but the degree of branching of the vine, which according to Husfeld should also be dihybrid, proved to be more complicated. The angle of the leaf sinus in Mourvèdre was + 80 and in *Rupestris* + 90, whilst in the hybrid it varied from -20 to + 150°. The hybrids varied also very widely in habit and types resembling both parental forms, together with all possible intermediates, segregated. This suggests that the economically important characters of the two species may also recombine in interspecific crosses.

The authors consider that the application of Husfeld's method of infecting the seedlings in the greenhouse is not justified until it has been experimentally proved that the reaction of young seedlings and mature plants is identical.

274. MOOG, H. 634.843.2.09
 Beiträge zur Ampelographie. (VI. Mitteilung.) (**Contributions on ampelography. VI.**)
 Gartenbauwiss. 1935 : 9 : 293-324.

A continuation of the systematic survey of varieties (Cf. "Plant Breeding Abstracts," Vol. V, Abst. 501) dealing in this communication with French hybrids and crosses from Geisenheim, among which a number of synonyms were found.

The paper opens with a criticism of a key recently formulated by Börner for the diagnosis of individual characteristics of varieties of vines.

275. WOODROOF, J. G. 634.848.1:575.252
Five strains of the Scuppernong variety of Muscadine grapes.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 384-85.

The Scuppernong variety of *Vitis rotundifolia* bears light coloured fruit of superior quality, and is usually cultivated in small numbers on arbours near farm homes. A study of the grapes from several hundred homesteads in North Carolina has shewn the presence of five strains, probably having their origin in bud mutations and varying in yield, flavour, season, colour and so on.

It is suggested that nurserymen should propagate the grape by strains and that the three best strains be used to ensure a succession of grapes from early August to early October.

276. SNYDER, E. 634.851:581.48:575
 634.851:575.11
Breeding for seedless Vinifera grapes.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 381-83.

In an effort to produce a seedless grape with the muscat flavour crosses have been made with Muscat of Alexandria or Muscat Hamburg, using various seedless forms as male parents, as a result of which many seedless grapes have been obtained, a few of which are being propagated for trial. Crosses have also been made using Black Monukka (seedless) as male parent with various other grapes, to produce seedless types.

Altogether of the 275 seedless grown, 85 per cent have fruited, and the production of 29 seedless or nearly seedless forms in the F_1 has proved the utility of seedless male parents.

In the inheritance of colour white has proved a pure colour, recessive to black, while the latter is usually heterozygous. The red colour varies in intensity from light to dark. Reflexed stamens occurred in 13.2 per cent of the seedlings, though all parents had upright stamens.

277. OLMO, H. P. 634.851:581.48:575.11
Empty-seededness in varieties of *Vitis vinifera*.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 376-80.

Many varieties of *Vitis vinifera* produce a proportion of empty seeds, as a result of which low germination percentages are obtained. The "empty" seeds, which float in water, are hollow, contain a degenerate endosperm and sometimes an embryo, and usually have different coloured seed coats. The percentage of empty seeds appears to be characteristic of the variety and so is probably inherited, but it varies considerably according to environmental conditions. In hybrids with *V. labrusca* fewer empty seeds are obtained on the F_1 plants, suggesting that the character is recessive. The fact that the pollen used does not affect the proportion of empty seeds indicates that it is governed by the maternal plant, irrespective of the genetical constitution of the embryo and endosperm.

FORESTRY 634.9

278. SCHANTZ, O. M. 634.972.1:575.127.2
An odd hybrid oak.
 Amer. Bot. 1934 : 40 : 3-5.

An unusual form was found amongst a group of *Quercus imbricaria*. On examination it proved to be a hybrid of *Q. alba* and *Q. macrocarpa* and has been named \times *Quercus Bebbiana Orpheusi* Pepoon and Trelease. The plant association in which it was found is a very old one, occurring as it does on a pre-glacial uplift.

279. REGNIER, R. 634.972.3(44)
 Les recherches sur les peupliers. (**Researches on poplars.**)
 Bull. Com. For. Paris 1934 : 9 : 42-61.

In introducing a programme of research on poplars the importance of recognising varietal differences in the reaction of poplars to the pathogen which causes canker in poplars is pointed out. The selection of resistant varieties will involve a thorough study of the different species and varieties, a large number of which have been collected in the nursery already established at Cuts near Noyon. Some preliminary notes on the reaction to various diseases are given. A classification and a description of a large number of poplars has been drawn up and includes occasional references to hybrid forms.

280. LANGE, L. 634.973:575.061.6:581.45
 Sämlingszucht der Verschiedenblättrigen Esche (*Fraxinus excelsior* L. var. *diversifolia* Aiton). [**Raising seedlings of the ash with diversiform leaves (*F. excelsior* L. var. *diversifolia* Aiton).**]
 Mitt. dtsch. dendrol. Ges. 1934 : No. 46 : 79-80.

Seedlings numbering 801 raised from about 4,800 fruits of a 24-year old garden ash comprised the following categories :—(a) 429 resembling the typical species with pinnate leaves ; (b) 187 with entire leaves (like the seedling leaves of the species) ; and (c) 185 which exhibited a mixed condition, having 8-10 entire alternate leaves on the lower portion of the stem, then 2-4 pairs of opposite leaves of the same shape as the foregoing, followed by 1-2 leaf pairs with a single unilateral incision in each leaf or (more rarely) a pair of pinnae.

Since the parent tree had been producing only ♀ flowers the fruits must have resulted from pollination by an ordinary pinnate leaved ash, and the two conditions of normal and abnormal leaf formation might be attributable to a single factor difference, *FF* producing normal and *Ff* abnormal seedlings. The possibility of an intensifying factor *V* for which the *diversifolia* variety would be heterozygous and the original parent type homozygous is considered. Further observations on the seedlings are being recorded.

281. WALTHER, E. 634.973-2.42-1.521.6:575.127.2
 634.973-2.7-1.521.6:575.127.2
Genetic constitution of host plant as a factor in pest control.
 Mon. Bull. Calif. Dep. Agric. 1935 : 24 : 242-44.

Specimens of *Platanus acerifolia* Willd. have been observed to differ in their susceptibility to infestation and damage by the sycamore scale, *Stomacoccus platani* Ferris, and sycamore blight, *Gnomonia veneta* (Sacc. and Speg.) Kleb. The explanation of this discrepancy appears to lie in certain slight but constant differences (e.g. leaf shape, etc.) between the host trees. Pending further study of the anomaly the writer suggests that the peculiarities of the less susceptible trees are due to the latter being second generation hybrids from *P. acerifolia* x *P. orientalis*, the typical *P. orientalis* characters being apparently more or less dominant.

282. LIESE. 634.975-2.19:575.252
 Zur Bildung von Kiefern-Hexenbesen. (**On the formation of witches' broom of pine trees.**)
 Z. Pflzk. 1935 : 14 (N.S.) : p. 55.

Evidence for the hereditary nature of this form of growth is briefly stated. Pine cones gathered from witches' brooms yielded a progeny half of which shewed the typical anomalous form of growth, while the other half of the progeny was normal. (Cf. "Plant Breeding Abstracts," Vol. V, Abst. 510). A second experiment gave similar results except for the presence of a group of intermediate types.

The author attributes the formation to bud mutation, asserting that the most careful investigation has never yet revealed the presence of a causal pathogenic parasite in the growth.

283. 634.976.26:575:578.08
634.972.3:575:578.08
VILL.
Die Züchtung von Laubweichhölzern. (**The breeding of soft wood trees.**)
Mitt. dtsch. dendrol. Ges. 1934 : No. 46 : 105-08.

The advantages of planting *Populus* species as compared with other trees as a source of soft wood is pointed out ; several methods of raising poplars from seed are outlined, including von Wettstein Westersheim's technique, and the hybrid seedlings raised at the Kaiser Wilhelm Institut at Müncheberg are described. (Cf. "Plant Breeding Abstracts," Vol. IV, Abst. 504.)

VEGETABLES 635

284. 635.13:575.42.061.6
MILLER, J. C.,
COCHRAN, F. D. and GARRISON, O. B.
Some factors affecting colour in carrots.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 583-86.

Inter alia it is mentioned that selection for good colour affords an opportunity of developing a strain of carrots that will colour well even under adverse conditions.

285. 635.25:575.127.2
635.25-2-1.521.6
EMSWELLER, S. L. and JONES, H. A.
An interspecific hybrid in *Allium*.
Hilgardia 1935 : 9 : 265-73.

Nebuka, a variety of *Allium fistulosum*, is resistant to pink-root (*Phoma terrestris* Hansen), smut (*Urocystis cepulae* Frost) and thrips. To investigate the possibility of transferring this resistance to *Allium cepa*, a number of crosses were made between Nebuka and certain varieties of *A. cepa* by hand pollination, fly pollination and open (uncontrolled) pollination.

The F_1 hybrids shew a slight degree of bulbing, less than *A. cepa* and more than *A. fistulosum*, which does not form bulbs. They are all perennial, like *A. fistulosum*, though *A. cepa* is biennial, while in vigour the hybrids excel both parents. In date and time of flowering as well as in type of inflorescence the hybrids are intermediate, but in flower habit they resemble *A. fistulosum*. The hybrids are all practically self-sterile, but will function as pollen parents in backcrosses on either parent. They can however, be multiplied rapidly by division.

On soil heavily infested with the pink-root organism the hybrids grew vigorously, and although some of the roots were infected there was apparently no check to growth. They have not yet been tested for smut resistance.

286. 635.25:575.127.2:576.354.4:576.312.34
EMSWELLER, S. L. and JONES, H. A.
Meiosis in *Allium fistulosum*, *Allium cepa*, and their hybrid.
Hilgardia 1935 : 9 : 277-94.

The chromosome morphology of *A. cepa* and *A. fistulosum* was studied in aceto-carmin smears of pollen grains, the ratio of the lengths of the arms of the respective chromosomes being determined. It is considered that the similarities between the complements shew that the two species probably spring from a common ancestor.

Meiosis in the two species and in their hybrid was also studied. In *A. fistulosum* the chiasmata are localized at the spindle fibre attachment point at metaphase I, while in *A. cepa* terminal chiasmata are found at this stage. In the F_1 hybrid the chiasmata were again terminal. Numerous irregularities were found in the hybrid, including pairing between chromosomes of different lengths and unpaired regions at pachytene, varying numbers of univalents (univalents were also found to some extent in the parents), and associations between long and short chromatids.

287. 635.25:581.192:581.6
PLATENIUS, H. and KNOTT, J. E.
Pungency of onions in relation to variety and ecological factors.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 593-95.

By a quantitative determination of the sulphur in the volatile oil obtained by steam distillation, the pungency of onions can be more accurately estimated than by tasting. On this basis the varieties tested could be grouped under three classes, distinctly mild, intermediate and decidedly strong.

Ecological factors also affect the result but in a minor degree.

288.

EMSWELLER, S. L. and JONES, H. A.

635.26:576.354.46:575

635.26:581.162.5:581.331.2

A gene for control of interstitial localization of chiasmata in *Allium fistulosum* L.

Science 1935 : 81 : 543-44.

Out of a population of seventeen plants from a back-cross of an *A. cepa* x *A. fistulosum* hybrid to *A. fistulosum* ten plants had interstitial and seven had terminal chiasmata. The most fertile all had localized chiasmata. On examining the situation as to chromosome pairing at MI it appeared that the two most fertile plants shewed no irregularities but neither did one of the most sterile. There was a complete lack of correlation between the percentage of good pollen and fertility, for instance the most fertile plant having 67 per cent good pollen and that next to the most sterile 99.3 per cent; there were fertile plants with a high percentage of good pollen and others with a low percentage, and a similar relation holds for sterile plants.

Assuming that type of chiasmata is gene controlled the ten plants with interstitial chiasmata should be homozygous recessives and the seven plants with terminal chiasmata should be heterozygotes, segregating into plants with terminal and plants with interstitial chiasmata. This hypothesis will be tested.

289.

CURRENCE, T. M.

635.34:575.12:635.36

Results from hybridizing cabbage with Brussels sprouts.

Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 485-87.

The ease with which they can be propagated from seed and grown in limited space make the sub-species of *Brassica oleracea* suitable material for breeding. Possibilities include the improvement of cabbage, development of a variety of Brussels sprouts adapted to as wide a range of conditions as cabbage and the development of new forms either combining the characters of both or intermediate. Of a number of types of crosses and selections, the F_2 of the Brussels sprouts x cabbage cross has proved most promising for improved cabbage, while backcrossing the F_1 to Brussels sprouts has yielded the best results from the point of view of improving the Brussels sprout and of producing a plant combining the characters of the two forms.

290.

NEGODI, G.

635.41:577.8:575.1

Comportamento ereditario del monoicismo in *Spinacia oleracea*. (The hereditary behaviour of monoicism in *S. oleracea*).

Riv. Biol. 1934 : 17 : Pp. 8.

A monoecious plant of *S. oleracea* which at first produced only female flowers was isolated and later developed also a number of male flowers. From the seed obtained from this plant 84 plants were grown which shewed the proportion of 90 per cent monoecious plants with a varying number of male flowers and 10 per cent of pure female plants and not a single example of an androecious plant. From two female plants with opportunities of open pollination from androecious and monoecious plants the following proportions were obtained: (a) from 111 plants 47 per cent of male, 45 per cent of female and 8 per cent of monoecious plants, (b) from 100 plants 41 per cent of male, 33 per cent female and 26 per cent of monoecious plants indicating that with the increase in the number of monoecious plants there was a decrease in the number of exclusively female plants.

The proportional distribution of monoecious and dioecious plants in the progeny of the self-pollinated monoecious plant is discussed and the author's interpretation of the results suggests that the sporadic occurrence of monoecious plants in this species is an heritable quality and not merely a phenotypical fluctuation of genetically female individuals.

291.

BREMER, A. H. and GRANA, J.

635.52:575:581.143.26.035.1

635.52:575.242

Genetische Untersuchungen mit Salat. II. (Genetic investigations with lettuce. II.)

Gartenbauwiss. 1935 : 9 : 231-45.

Tabulated results are first given shewing that certain varieties of lettuce, e.g. Kaiser Treib (Marktkönig) shoot more rapidly than others but on exposure to reduced length of day shooting is delayed by from 3-4 weeks and good heads are formed. A long day lettuce which under

natural conditions of length of day rapidly forms shooting stalks also shoots proportionately rapidly with shorter daylight periods; and under similar conditions a long day lettuce which naturally forms shoots late is correspondingly late in bolting.

This difference between long day and neutral day varieties depends on a single factor pair designated *T* (dominant) for the early shooting combined with long day and *t* (recessive) neutral day combined with late shooting.

From three crosses between the spring lettuce Maikönig and Deacon evidence was obtained suggesting that Maikönig carries an inhibiting factor acting upon the length of day factors and delaying the formation of shoots; such factors also appear to produce the same effect with long or short day conditions.

Another factor is described which induces rapid shooting with long day conditions and appears to act equally effectively on the various lettuce varieties.

Among a number of Kaiser Treib lettuces (which are long day plants) a supposed mutant individual was found that formed shoots more quickly than Kaiser Treib under both long and short day conditions. This plant which proved constant formed only a rosette with short day periods and was called "Kurztagrosette I." On crossing Kurztagrosette I with neutral day lettuce ratios were obtained indicating that the factor for heading *k* is recessive, operating only when the factor for rosetting *K* and the factor *T* are absent or when *T* is inactive owing to short day conditions. It is concluded that heading is conditioned by *ttkk* with long day and *ttkk* or *Ttkk* or *TTkk* with short day conditions.

An examination of the behaviour of certain wild varieties gave reason to suppose that the factor for length of day arose by mutation after lettuce was taken into cultivation. The wild varieties *Lactuca scariola*, *L. saligna* and *L. virosa* proved to be neutral day plants, like the neutral day summer lettuce (*L. sativa*). It seems, however, possible that one allelomorph or several for *T* and *t* may ultimately be discovered in the factors for shooting in *L. scariola*. (Cf. "Plant Breeding Abstracts," Vol. II, Abst. 154).

292.

PANGALO, K. I.

(Key to the varieties of Cucurbits.)

Lenin Acad. Agric. Sci., Inst. Pl. Ind. 1934 : Pp. 56.

635.61

635.62

A monograph consisting of descriptions of all the varieties in the world collection of water melons, melons and pumpkins and squashes, based on the personal observations of the author. In each group the main distinguishing features of the various species and *proles* are indicated, the various characters used in the descriptions and keys are defined, and a key is given to the varieties, which are then described in turn, briefly but fully. In this way 47 varieties of water melon, 42 varieties of melon and 13 of pumpkins and squashes are defined.

293.

ARASSIMOVICH, V. V.

635.61:575.11:581.192.2

(On the inheritance of sugar content in cucurbits.)

Bull. Appl. Bot. Leningrad 1934 : Ser 3 (5) : 5-31.

The work of earlier investigators on the inheritance of chemical characters is briefly reviewed, reference being made to observations by Soviet workers on the sugar content in melons and water melons, where it was found that both the total sugar content and the proportion of saccharose to monosaccharides was greatest in the more cultivated species, less in the semi-wild and least of all in the wild species. In the present investigation analyses were made of a number of hybrids to study the inheritance of sugar content in crosses between species of the different types and the results are tabulated. The F_1 hybrid tended to be intermediate, but in certain cases it approached much closer to the one than to the other parent. The fall in sugar content was much more marked in crosses of a parent of high sugar content than in crosses of a parent of moderate sugar content with low sugar forms, which is a sign of the genetic complexity of the character. Heterosis, sometimes very marked, was observed in the F_1 of some combinations, falling again in the F_2 . In some of the combinations marked segregation occurred in the F_2 , with the production of both intermediate forms and forms resembling the parents. In other combinations this was not so and the F_2 consisted almost entirely of intermediates.

When the individual sugars were studied a similar behaviour was observed : the F_1 with regard to fructose was mainly intermediate, sometimes resembling one or other parent and sometimes exceeding the higher parent by as much as 100 per cent or more, whilst occasionally it was also lower than the lower parent. In one cross in which one parent contained no fructose, the F_1 contained it in a proportion exactly equal to that in the other parent. Segregation occurred in F_2 , there being often a general fall in fructose content as compared with the F_1 ; an individual segregated however from one cross having a fructose content twice that of the higher parent. There can be no doubt that the character is polymeric, and that the genes occurring in some forms are dominant and those in others recessive.

In respect of glucose content the same behaviour was observed as for fructose in the F_1 but in the F_2 there was a general tendency to an increase rather than decrease ; thus the majority of the glucose genes would appear to be dominant.

The reverse position was observed in sucrose content, the tendency being towards a reduction in both F_1 and F_2 indicating the recessivity of the sucrose genes ; heterosis was observed however in the F_1 of certain crosses, and in some there was a rise in sucrose content in the F_2 rather than the usual fall, with the segregation of forms exceeding the parents.

There was no connexion in any of the crosses between the behaviour of the different sugars, which are evidently conditioned by different sets of genes.

In the attempt to elucidate in more detail the genetic nature of sugar content a series of crosses was made using the same variety *Cucumis microcarpus* No. 1401 and combining it with *C. flexuosus* and *C. melo agrestis* (low sugar) on the one hand and *C. melo* (high sugar) on the other. In the first two cases the F_1 was intermediate in sugar content, the majority of the sugars consisting of monosaccharides as in the low sugar parent. The sugar content of the F_1 in the cross with the cultivated *C. melo* however was the same as that of *C. microcarpus* and the vast majority of the F_2 plants were of the same type. The cross of *C. microcarpus* with Bokharka, another very sweet and juicy cultivated melon with the same high proportion of sucrose, exemplified the reverse case, in that both F_1 and F_2 resembled Bokharka, except for a slight tendency to an increased percentage of reducing sugars and a corresponding reduction of sucrose.

No difference was observed in the analyses of reciprocal hybrids.

294. CURRENCE, T. M. and LEACH, J. G. 635.611-2.484-1.521.6:575
Progress in developing muskmelon strains resistant to *Fusarium*.
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 481-82.

In an endeavour to produce a muskmelon resistant to a *Fusarium* wilt of unknown origin a number of commercial varieties were grown on diseased soil in 1933 together with seedlings from selfed normal Benders Surprise growing on diseased soil. Many of the varieties and nearly all the inbred selections were 80-100 per cent susceptible. Honeydew, Casaba, Persian and Honey Ball shewed considerable resistance, and one selection appeared to be intermediate between the resistant and susceptible types, apparently being a hybrid between Bender's Surprise and Honeydew. Some healthy plants were selfed and the seed grown in 1934, and from certain promising types it is hoped to obtain a resistant type suitable to the district.

295. MAHONEY, C. H. 635.611-2.8:581.48:575
Seed transmission of mosaic in inbred lines of muskmelons (*Cucumis Melo* L.)
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 477-80.

Seedlings of 48 inbred progenies were grown in wood veneer bands, set in a sash-covered frame which had not previously been used for growing melon or cucumber plants. Certain of them developed mosaic. On planting in the field the disease spread rapidly, and infected and non-infected fruits were marked. The seed was collected from these and grown in the greenhouse. Every fruit which had been diseased produced diseased seedlings, while three which were not infected produced uninfected seedlings.

These facts, taken with the very early appearance of infection in the seedlings, are presented as evidence that seed transmission of mosaic occurs in the strains concerned.

296. LJAŠČENKO, I. F. 635.62:577.831
635.62:581.466
(An interesting case of flowering in pumpkins.)
Bull. Appl. Bot. Leningrad 1934 : Ser.A (12) : 167-68.
In two lines of *Cucurbita moschata*, one of v. *japonica* and the other of v. *indica* certain plants were observed with unusual flowers, which proved to be of two types, one of which had every appearance of a female flower but bore a group of stamens in place of the style, the other type being hermaphrodite. Fruits were produced by both types but were all highly abnormal. A similar phenomenon has later been observed also in *C. Pepo* and *C. turbaniformis*.
297. SCOTT, G. W. 635.623:575.14
Observations on some inbred lines of bush types of *Cucurbita pepo*.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : p. 480.
Observations of second and third inbred lines from commercial seed of three bush varieties indicate that, provided rigid selection is practised to eliminate lines of low vigour, the variations brought forth and the ease with which they may be isolated in the homozygous condition make inbreeding a practical means of improvement of these varieties. Self-sterility in the inbred lines has not been a factor to contend with in this material.
298. BAILEY, R. M. and BURGESS, I. M. 635.63-2.484-1.521.6:575.11
Breeding cucumbers resistant to scab.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 474-76.
Inbred strains of 22 varieties of cucumber were inoculated in the greenhouse with spores of the fungus (*Cladosporium cucumerinum*) causing scab, and were also grown in the field with diseased fruits scattered about to provide an inoculum. The results in the two cases were consistent and shewed that resistance occurs very rarely. All plants producing scabby fruits also had scab lesions on stem and leaves, but the converse was not true, so that the occurrence of lesions on stem and leaves is the best criterion of infection.
In a study of the inheritance of resistance, selfing was continued in the resistant lines. Certain of them bred true for resistance while others segregated into resistant and susceptible strains, indicating that resistance is dominant. In five crosses between resistant and susceptible strains the results were consistent with the hypothesis that resistance is determined by a single dominant factor, 1:1 or 1:0 ratios being obtained in the F_1 's, but in a sixth cross a 3:1 ratio was obtained, suggesting either the presence of dominant complementary factors for resistance or that the parent which had been considered susceptible on the basis of the previous behaviour of the strain, was really heterozygous for resistance.
299. KOSTOFF, D. and AXAMITNAJA, I. A. 635.64:576.356.5:581.192
Studies on the polyploid plants. IX. Chemical analysis of diploid and their autotetraploid plants.
C.R. Acad. Sci. URSS. 1935 : 2 : 293-97.
Comparative chemical analysis of the leaves of diploid tomatoes and the corresponding autotetraploids shewed differences which could be correlated with the larger and fewer cells and greater amount of cytoplasm in the latter.
300. HOWLETT, F. S. 635.64:581.162.2.04
The effect of carbohydrate and of nitrogen deficiency upon the male sex cells in the tomato.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 448-49.
The development of pollen grains is greatly hindered by carbohydrate deficiency, but is not much affected by nitrogen deficiency. Data, not yet published, shew that on the female side the reverse holds, i.e. suppression of ovules following nitrogen deficiency and indifference to carbohydrate deficiency.

301. FRETTS, G. P. and WANROOY, G. 635.652:575-18:581.47
Die Erbllichkeit der Bohnenform und des Bohnengewichtes bei *Phaseolus vulgaris*. III. Die auf F_1 -Pflanzen gewachsenen Bohnen, also die F_2 Samen-generation. (The inheritance of bean shape and size in *P. vulgaris*. III. The beans on the F_1 plants, i.e. the F_2 seed generation.)
Genetica 1935 : 17 : 47-89.

In 1933 in continuation of this experiment (Cf. "Plant Breeding Abstracts," Vol. V, Abst. 530) plants of lines I and II were again raised and shewed no signs of heritable variation for the characters in question, though environmental modifications were clearly evident. Reciprocal crosses between lines I and II were also repeated and bore out the 1932 data. The $I \times II$ cross displayed clear evidence of matrocliny, which was possibly not so marked in the $II \times I$ cross. In general the phenotype of the F_1 plants could be termed uniform.

The F_2 seed generation, obtained by selfing the F_1 plants from the $I \times II$ and the $II \times I$ crosses resembled each other in regard to the characters under investigation.

A comparison of the measurements of the F_2 seed generations from the crosses $I \times II$ and its reciprocal seemed to indicate that the greater length and greater breadth of the beans of line I and the greater thickness of those of line II were all three possibly more or less dominant to the relatively smaller length and breadth of line II and the smaller thickness of line I.

The variability observed in the F_2 seed generation is discussed. The curves for length measurements from the $I \times II$ crosses supplemented (while the article was in the press) by data from an F_3 seed generation shewed that genetic variations were involved.

Various back-crosses made are described, and a further communication on the results from the F_3 seed generation will be included in a general survey of the whole investigation.

302. MAHONEY, C. H. 635.652-2.8-1.521.6:575
Breeding snap beans for mosaic resistance. A progress report.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 483-84.

A large number of selections from commercial varieties and from several crosses have been tested under field conditions, using commercial Stringless Green Refugee as a check. No artificial inoculation has been employed.

Progenies shewing no infection in the field have been obtained in the F_8 from a cross of Wells Red Kidney by Refugee Wax. Other resistant forms shewing low infection have been produced, and segregation was found in the F_4 to F_8 generations by analysis of pod lengths and number of pods per plant in 17 progenies.

303. GRAHLE, A. 635.655:575.12:581.162.3
Beobachtungen über den Fruchtansatz bei künstlicher Bestäubung von Sojabohnen. (Observations on the set of fruit in artificial pollination of soya beans.)
Angew. Bot. 1935 : 17 : 144-49.

In the summer of 1934, 283 pollinations were made in the course of 27 days and of these 76 (= 26.9 per cent) set seed, though only in 59 cases (= 20.8 per cent) was mature seed procured. It was observed that the vigour of the mother plant had no effect on the set of seed; the Manchurian forms were the least successful and the late maturing varieties were also inferior to the earlier ones, which is partly accounted for by the less favourable weather conditions which obtained when these late varieties were being pollinated. Observations were made on the influence of weather conditions on the set and the conclusion reached that dry but not too hot days combined with a sufficiency of soil moisture provide the most favourable conditions for crossing.

304. DIX, W. 635.656:575
Züchtungsversuche mit Erbsen. (Breeding experiments with peas.)
Landw. Jb. 1934 : 80 : 853-81.

Crosses were made between a number of pea varieties in fourteen different combinations all involving a Vilmorin variety characterized by the formation of 3-5 pods per stem and silverish green seed coat. The first cross referred to is between this variety and Victoria, having yellow

seed coat and cotyledons. The seeds of the F_1 plants were uniform, whilst the F_2 generation, consisting of 256 plants, contained 40 plants with only yellow seeds, 30 with only green and 186 with both yellow and green. Neither the plants with pure yellow nor the pure green seeds however gave pure progeny but all segregated in the following generations, the former giving both green and yellow and the latter also other colours; the products of segregation were very similar to those of the F_2 plants which bore seeds of both colours. Such results cannot be explained by any theory of dominance or by the presence and absence theory, a contention which is further illustrated by a cross of the green Vilmorin variety with Weender Viktoria, whose F_2 contained 35 plants with only green seeds, 45 with only yellow, 81 with green and yellow and 19 with yellow and grey-green or yellow-green. The latter group is taken as illustration of the fact that both the factors for green and yellow are present together, which is still more clearly illustrated by certain plants in which one half of the seed is one colour and the other half the other, or in which a background of one colour with flecks of the other appears. Moreover, in addition to the new colours that appear, such as olive, grey, arsenic green, purplish brown, etc., quite large variations in the shades of all colours, yellow and green included, are evident, and these colour shades are transmitted to the progeny without segregation, which is thus not in accordance with the explanation of polymeric factors; many of the colours are moreover more intense than that of the parents.

The theory of multiple allelomorphs is also rejected as an explanation, since all these numerous shades occur in the progeny ultimately derived, presumably by selfing, from a single individual, since cross-pollination in the pea is very rare.

The author explains the results on his theory of "genules" (see "Plant Breeding Abstracts," Vol. II, p. 98), assuming that the factors for green and for yellow occur in the Vilmorin variety in the same chromosome but the linkage is broken on crossing. The segregation of the different "intensities" contributed by the green and yellow genes of the Vilmorin pea and the yellow gene contributed by Victoria account for the various shades arising from segregation. The constancy of the shades is further explained by a reestablishment of the linkage owing to the genes for green and yellow being in the same chromosome. Certain combinations of "intensities" are regarded as being sensitive to differences of acidity, etc., between the cells and so give rise to the flecked forms.

Essentially similar results were observed in the inheritance of thousand seed weight, seed size and other characters in the same cross.

In a further cross between this same Vilmorin variety and *Pisum arvense* having grey-yellowish-greenish seeds, as many as 85 different seed coat colour types appeared, including both self-coloured and flecked. These were again mostly inherited constantly, and a similar explanation is offered. The same phenomenon was observed also in respect of size and shape of seed, and the length of time required for cooking, which varies from half-an-hour to over two days.

305. KRAJEVOJ, S. 635.656:576.312.36:537.531
 (Experimental production of mutations in *Pisum* I. Lingering chromosome modification produced by X-rays).
 C.R. Acad. Sci. URSS. 1935: 1: 549-53.

Young seedlings of five pure lines of *P. sativum* var. *glaucospermum* were treated with X-rays when their roots had reached a length of $\frac{1}{2}$ cm., the roots of each plant were fixed at intervals during development, using Levitsky's method. Several plants showed chromosomal aberrations, the aberrant cells frequently having chromosomes of abnormal thickness and without satellites. The same aberrations were observed in the first generation obtained from the irradiated plants, though in much lower proportions, and the aberrations are thus referred to as "lingering"; they had almost disappeared in the second generation of seedlings.

The plants displaying the chromosomal aberrations were externally identical with the normals. Aberrant plants were crossed reciprocally with the initial normal plants, in which case where the normals were used as female no aberrations occurred in the F_1 or F_2 hybrids, but in the reciprocal cross 9.3 per cent of aberrants appeared in F_1 and 0.4 per cent in F_2 , thus indicating the action of the plasma on the morphology of the chromosomes.

306. KRAJEVOJ, S. 635.656:576.356:537.531:581.162.5
 (Experimental production of mutations in *Pisum*. II. Permanent semi-sterility caused by X-rays).
 C.R. Acad. Sci. URSS. 1935 : 1 : 553-58.

X-ray treatment of young seedlings of a pure line of *Pisum sativum vulgare* produced a number of abnormalities in the resulting plants. These were sown separately and in one of the resulting families a plant appeared which differed from the type in a number of characters, being thinner and more tender and at the same time displaying 50 per cent sterility in the pollen grains. This semi-sterility has been transmitted to the succeeding generations, of which the third is now growing.

Serious irregularities of the reduction division consisting of the lagging and loss of many of the chromosomes were observed at meiosis. The mutant plants were crossed reciprocally with the initial form and all crosses produced giant F_1 plants which however displayed 25 per cent pollen sterility. The meiotic irregularities in the hybrid were less pronounced.

307. BANDORINA, M. M. 635.656.00.14(47)
 635.656-2.7-1.521.6
 (Results of varietal trials with peas.)
 Semenodovstvo (Seed Growing) 1935 : No. 5 : 44-48.

The results of five years' tests of a number of varieties at a number of places in respect of yield, quality, time of maturity and resistance to the moth *Grapholitha dorsana*. Certain varieties proved highly resistant and it is urged that serious attention be given to the breeding of suitable resistant varieties.

308. MAHONEY, C. H. and MUNCIE, J. H. 635.67-2.3-1.521.6:575
 633.15-2.3-1.521.6:575
 Is resistance to bacterial wilt in sweet corn heritable?
 Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 458-73.

To determine whether resistance to bacterial wilt (*Phytophthora Stewartii*) in sweet maize is heritable, numerous commercial varieties, hybrid maizes and inbred strains were grown in 1933 and 1934.

In 1933 wilt developed early in the season, and a high negative correlation was obtained between final percentage of infected plants and days to edible maturity, also between final per cent wilt and yield of marketable ears. No correlation was obtained between seedling infection and final wilt reading or yield of marketable ears. Using the high linear correlation first mentioned, the percentage of wilt, using days to maturity as the independent variable, was calculated and compared with the observed figure in two groups. In the first, consisting of seven inbred selections of Golden Bantam, the deviations were not significant; in the second, comprising 14 hybrid maizes, 7 shewed minus deviations which were apparently significant. Both groups, however, when tested for homogeneity by the chi-square method, appeared to be taken from a homogeneous population.

In 1934 much drier conditions obtained in the early part of the season, and wilt did not develop until the earliest varieties were approaching edible maturity, as a result of which the latter escaped the disease. The remaining varieties were grouped into five classes and Fisher's analysis of variance was applied. A significant difference was found between mean wilt percentage of the F_1 and F_2 Golden Bantam inbred, and a barely significant difference between 75-85 day commercial varieties and 86-98 day hybrids. In these five groups no correlation was obtained between percentage of wilt infection and days to maturity.

Discussing the results, the author points out that the only strains which had significantly lower infections were hybrids exhibiting marked heterosis. In 1934 the early varieties practically escaped the disease, but in 1933 many were almost wiped out, shewing that environmental conditions may also play a part. Again certain varieties, though shewing a high percentage of infection, matured a crop, indicating that they are to some extent disease tolerant.

It is suggested that the best breeding method for control of this disease would be the production of higher quality, vigorous, early sweet maize hybrids, care being necessary to ensure that sufficient hybrid vigour is obtained.

309. POOLE, C. F. 635.67-2.7-1.521.6
633.15-2.7-1.521.6
Corn-earworm resistance in maize varieties at Davis, California, 1934.
Proc. Amer. Soc. Hort. Sci. (1934) 1935 : 32 : 453-57.

In considering resistance to corn earworm (*Heliothis obsoleta*, Fab.) the most important factor commercially is the percentage of marketable ears. Another item of importance, which was also studied in this investigation was the extent of injury to the ears, indicated by an injury index varying from 5 (ears free from attack) to 1 (ears damaged beyond marketability). These qualities were measured for 29 sweet-corn types and 10 field types, which are listed in order of their percentage of marketable ears. More severe injury followed planting on 26th May than on 18th April, except in Surecropper Sugar, Honey June and Mexican June, where the reverse was true. No significant correlation was obtained between insect injury and projection of husks past the tip of the ear. Significant positive correlations were obtained between injury index and time taken to mature, and between injury index and tallness, shewing that the tallest varieties are the latest maturing, and that the tallest and latest are freest from injury. By inspection of the figures, correlation can be observed between length of husked ears and percentage of marketable ears, which is ascribed to the fact that the best yielding varieties in this test are field varieties, or sweet corn types like Honey June, Surecropper Sugar and Florida 191, which have lately been derived from field types.

The results of a small scale commercial trial are given.

310. OIKAWA, K. 635.8:577.81:575.12
(**Sex in *Cortinellus Shiitake*.)**
Bot. Mag. Tokyo 1935 : 49 : 453-55.

This edible fungus exhibits bi-polar sexuality. The existence of numbers of geographical strains differing in sex was proved by experiments on conjugation.

BOOK REVIEWS

SINNOTT, E. W.

Botany : Principles and problems.

McGraw-Hill Publishing Company Ltd. London 1935 : 21s. Pp. xix + 525.
310 figs.

58
575.1

For an elementary textbook this work covers a very wide range of subjects, practically every aspect of modern botany being dealt with, though the treatment is sometimes necessarily rather cursory. The classification of the vascular plants has been revised in this, the third edition, and they are divided into Lycopsidea, Sphenopsida and Pteropsida, the last including the ferns, Gymnosperms and Angiosperms. Some idea of the outlook of the author may be derived from the fact that only about six pages are devoted to the systematics of the Angiosperms. The elements of Mendelism are dealt with, the reader being taken as far as linkage and the chromosome theory of heredity, and the main theories of evolution are also reviewed.

TANSLEY, A. G. and JAMES, W. O.

Elements of plant biology.

George Allen and Unwin Ltd., London 1935 : 10s. 6d. Pp. 389. 60 figs.

58
575.1

Tansley's original "Elements of Plant Biology" has been revised and brought up to date by Dr. W. O. James. Though the book is primarily designed for medical students, and is in accord with the new syllabus for First M.B., it is also suitable for senior schools and general readers.

As the title implies, plants are treated first and foremost as living organisms, relatively more emphasis being thrown on physiological aspects and on the lower organisms. The vascular cryptogams are treated very briefly, mainly to illustrate alternation of generations, but the flowering plants receive comparatively lengthy treatment, as "the present frontier of evolution."

Mitosis is described in the chapter on the cell, and another chapter is devoted to heredity and evolution.

Details are given for practical work at the ends of the chapters.

632.001.4(42)

List of common names of British plant diseases.

Cambridge University Press 1934 : 2s 6d. Pp. 95.

The revised list in this second edition contains the names of 7 additional hosts and some 50 additional diseases. The scientific names of various pathogens have been revised in conformity with the International Rules of Botanical Nomenclature.

Suggested emendations or additions are invited for a future edition of this valuable handbook for research workers and translators.

BESSEY, E. A.

A text-book of mycology.

P. Blakiston's Son and Co., Inc. Philadelphia 1935 : \$4.00. Pp. xv + 495.
139 illus.

632.4
582.8

This new textbook of pure mycology deals chiefly with the morphology, life histories and relationships of the fungi, such aspects as sex, physiological forms and races, and hybridization in the fungi being treated incidentally.

The plan of the book follows the author's classification, which differs somewhat from the usual; the rusts and smuts, for instance, are separated from the Basidiomycetes and placed in a separate class (Teliosporae), though their affinities with the former are, of course, realized.

In connexion also with these organisms, the extent to which the book is dominated by a purely mycological point of view is shewn by the fact that the use of rust-resistant varieties as a method of control is not mentioned.

The references to literature cited form a feature of this book, and are written out in full to avoid mistakes resulting from the use of abbreviations, while pages 395-468 are devoted to a guide to literature for identifying fungi.

GROVE, W. B.

632.482

British stem- and leaf- fungi (*Coelomycetes*). A contribution to our knowledge of the Fungi Imperfecti belonging to the *Sphaeropsidales* and the *Melanconiales*. Volume I.

Cambridge University Press 1935 : 21s. 0d. Pp. xx + 488. 31 figs.

This, the first volume of a work describing the British *Coelomycetes*, deals with the *Sphaeropsidales* to the end of the *Scolecosporae*, the bulk of the volume being concerned with morphological descriptions of each species. There is a key to the genera, the species in each genus being arranged under their respective host plants.

Latin diagnoses of 24 new species are given, and separate indexes of hosts and parasites are provided.

The work is monumental in its exhaustiveness and is moreover extremely well printed, presented and indexed.

RATHSACK, K.

633.491:581.6

Der Speisewert der Kartoffel. (*The cooking quality of the potato.*)

Verlagsgesellschaft für Ackerbau m.b.H. Berlin 1935 : RM. 7.50 : Pp. 140 : 19 figs. 3 pls. 49 tables.

The importance of a thorough understanding of the qualities of economic plants has been recognized in many cases and studies have been made not only of the quality itself, but also of its reaction to the environment and other conditions. Very little, however, is yet known of the factors involved in the cooking quality of the potato and the present work represents the first study on a physical and chemical basis of this important problem.

The degree of disintegration on cooking (Z) is defined and determined and also the resistance to cutting pressure (S). These are then investigated in relation to chemical composition. The cooking process is investigated in relation to time of storage, processes induced in the tuber during cooking are studied and finally, besides the differences in chemical composition within the tuber, the relation between chemical constitution and taste is considered.

FREISE, F. W.

633.88(81)

Plantas medicinaes Brasileiras. (*Brazilian medicinal plants.*)

Secretaria da Agricultura, Industria e Commercio do Estado, São Paulo 1934 : Pp. 245.

A volume devoted to descriptions of all those plants that are used at all extensively medicinally in Brazil and whose identity has been established. The plants are dealt with alphabetically according to their Portuguese name, the Latin name, family and synonyms being also given. The descriptions are brief but include information on the chemical composition of the parts used medicinally, on the natural habitat, on the mode of utilization and on the medicinal properties of the plants.

There is an index of the Latin names and the volume constitutes a very useful and usable compendium.

HAUCH, L. A.

634.972.1:575.4(48.9)

The oak in Denmark.

Gyldendalske Boghandel Nordisk Forlag København 1934 : Pp. 29.

A pamphlet dealing with the growing of oaks in Denmark. The oak can grow on many sites where other tree species are unable to thrive and thus is very useful for afforestation in Denmark. A scarcity of acorns from native trees has led in many cases to use of foreign seed, which is often less satisfactory than Danish, though forests from the latter need more careful treatment. In either case, from his own long experience the author stresses the need for dense seeding. The ability of foreign forms to accommodate themselves to the more severe climate of Denmark is discussed in the light of Johannsen's theory of the pure line.

INDEX

- Aamodt, O. S., 12, 25, 39, 43, 44, 68,
155, 185
Abbott, E. V., 213
Agharkar, S. P., 78
Alderman, W. H., 249
Andreeva, N. V., 160
Andronescu, D., 30
Angelo, E., 249
Anonymous, 35, 45, 67, 82, 118, 157,
165, 176, p. 99
Antropov, V., 161
Arassimovich, V. V., 293
Arceneaux, G., 214
Artemova, A., 137
Auchter, E. C., 241
Axamitnaja, I. A., 299
- Bachmayer, I., 273
Bailey, R. M., 298
Balasubrahmanyam, R., 84
Bandorina, M. M., 307
Beatus, R., 102
Beketowskij, D. N., 233
Berg, H. M. vom, 140
Berzips, E., 206
Bessey, E. A., p. 99
Bhaduri, P. N., 78
Biggar, H. H., 183
Blake, M. A., 252, 254
Blakeslee, A. F., 96, 104
Blum, H. F., 99
Boeuf, F., 131
Bogorodskij, M. A., 120
Bole, S. J., 245
Bonne, 215
Börner, C., 272
Bourne, B. A., 212
Boyle, L. W., 207
Bremer, A. H., 291
Breslavac, L. P., see Breslavetz,
L. P.
Breslavetz, L. P., 103, 208, 209
Brink, R. A., 9, 168, 169
Bryan, W. E., 260
Burgess, I. M., 298
Bustarret, J., 150
- Caffrey, D. J., 37
Câmara, A. de Sousa da, 106
Cartledge, J. L., 96
Castella, F. de, 79
Champion, H. G., 81
Cheesman, E. E., 11
Chevalier, A., 199
Chevalier, R., 150
Chiappelli, R., 188
Chmelar, F., 149
Clark, J. A., 27, 152
Clark, J. H., 268
Cochran, F. D., 284
Colby, A. S., 267
Collins, E. J., 61
Collins, G. N., 175
Crépin, C., 153
Cullinan, F. P., 253
Currence, T. M., 289, 294
- Darlington, C. D., 3, 100
Dash, J. S., 56
- Davy, J. B., 80
Degman, E. S., 241
Dekaprelović, L. L., 182
Demerec, M., 95
Derewitzky, N., 86
Dianova, V. I., 237
Diehl, R., 115, 197
Dix, W., 304
Drain, B. D., 114
Dutt, N. L., 69
- Eden, T., 4
Einset, O., 242
Ellison, W., 194
Emme, E. K. (Emme, H.), 158
Emsweller, S. L., 285, 286, 288
Engledow, F. L., 15
Ermakov, A. I., 230
Evreinoff, V. A., 243
- Flaksberger, K., 132
Flint, W. P., 38
Fraser, J. G. C., 22
Freire, C. V., 228
Freise, F. W., p. 100
Frémont, T., 255
Frets, G. P., 301
Frimmel, F., 122
Fukushima, E., 189, 248
- Gardner, V. R., 251
Garrison, O. B., 284
Gfeller, F., 22
Glendon Hill, A., 70
Gorškov, I., 121
Goulden, C. H., 26
Grahle, A., 303
Grana, J., 291
Graner, E. A., 269
Gregor, J. W., 2
Grove, W. B., p. 99
Grubb, N. H., 77
- Hanna, W. F. 5, 6,
Hariharan, P. V., 50
Harlan, H. V., 186
Harland, S. C., 62-64
Harrison, T. J., 42
Haslam, R. J., 74
Hauch, L. A., p. 100
Hayes, W. P., 113
Hector, G. P., 52
Horne, F. R., 2
Howard, A., 20
Howlett, F. S., 247, 300
Hunter, H., 33
Huskins, C. L., 24
- Isshiki, S., 190
Ito, H., 248
- Jack, H. W., 76
James, W. O., p. 98
Jenkins, M. T., 172
Jeswiet, J., 123
Job, M. M., 151
Johnson, T., 7
Johnston, W. H., 39, 43, 44, 68, 185
Jones, D. F., 181
- Jones, E. T., 32
Jones, H. A., 285, 286, 288
- Kachidze, N. T., 177
Kaniewski, K., 91
Kasparyan, A. S., 94
Katayama, Y., 142, 144
Kawakami, J., 145
Kerr, H. W., 71
Kertesz, Z. I., 240
Khanna, K. L., 73
Khmura, M. J., 219
Kiesselbach, T. A., 36, 180
Kihara, H., 135, 143
Kilduff, T., 25
Kniševetskaja, T. I., 229
Knott, J. E., 287
Knyaginichev, M. I., 147
Kondo, M., 190
Konstantinov, N. N., 200
Kosmodem'janskii, V. N., 225
Kostoff, D., 216-218, 220, 222, 223,
226, 299
Kovalev, N. V., 250
Krajevov, S. J., 235, 236, 305, 306
Krasniuk, A. A., 162, 164
Krayevov, S., see Krajevov, S. J.
Kreier, G. K., 234
Krishnaswami, N., 46, 85
Krug, C. A., 174
Krumbhaar, C. C., 214
K-skii, A., 232
Kuckuck, H., 41
- Länge, L., 280
Lantz, H. L., 245
Leach, J. G., 294
Lennox, C. G., 211
Li, H. W., 187
Liese, 282
Lilienfeld, F., 135
Lindstrom, E. W., 171
Livermore, J. R., 87
Ljaščenko, I. F., 296
- MacIndoe, S. L., 34
Mack, W. B., 108
Macrae, N. A., 74
Mahoney, C. H., 295, 302, 308
Malinkovsky, M., 201
Mangelsdorf, A. J., 72
Mangelsdorf, P. C., 173
Martini, M. L., 186
Mather, K., 134
Miège, E., 154
Miles, S. R., 88
Miller, J. C., 284
Mitra, S. K., 53
Moniuszko, V. A., 258
Moog, H., 274
Morinaga, T., 189
Moritz, O., 97
Morris, G. P., 19
Moschkov, B. S., 126
Muncie, J. H., 308
- Naghbin, Y., 202
Nakatomi, S., 204
Namikawa, S., 145

Index continued.

- Nasaryeva, Z. D., 164
 Navashin, M., 119
 Neatby, K. W., 13
 Nebel, B. R., 240, 246
 Negodi, G., 290
 Negrul, A. M., 270, 273
 Nesterenko, P. A., 229
 Newton, M., 7
 Nilsson-Ehle, H., 117
 Nishiyama, I., 159
 Nixon, R. W., 259
 Nohara, S., 231
- Oehler, E., 23
 Oikawa, K., 310
 Olmo, H. P., 224, 277
 Oort, A. J. P., 128
- Pal, B. P., 28
 Panduranga Rao, V., 47, 48
 Pangalo, K. I., 292
 Panshin, B. A., 210
 Papadakis, J., 130
 Parthasarathy, N., 58
 Pavlova, N. M., 265, 266
 Pelshenke, P., 29
 Pires, D. R. V., 107
 Platenius, H., 287
 Poddubnaja-Arnoldi, W., 238
 Pod'japol'skii, S. P., 203
 Pomeroy, C. S., 256
 Poole, C. F., 309
 Popp, W., 5
 Postelt, 129
 Prokofieva, A. A., 226
- Radjably, I. (Rajably, I.), 216, 218
 Rădulescu, E., 110
 Rajabhooshanani, D. S., 1, 50
 Ram Dhan Singh, C., 17
 Ramanatha Ayyar, V., 84
 Ramanujam, S., 57, 58
 Ramaswami, K., 59
 Ramiah, K., 54, 58
 Randolph, L. F., 178
- Rangaswami Ayyangar, G. N., 46-50, 85
 Rathack, K., p. 99
 Rave, L., 221
 Raw, A. R., 14
 Rees-Leonard, O. L., 196
 Reeves, R. G., 173
 Regnier, R., 279
 Rhoades, V. H., 184
 Riebesel, G., 239
 Robb, W., 31
 Ronsdorf, L., 112
 Roth, H., 193
 Rozanova, M. A., 261, 262
 Rudloff, C. F., 109
 Rudorf, W. (Rudof, W.), 151
- Saillard, É., 191
 Salaman, R. N., 60
 Salmon, E. S., 75
 Sando, W. J., 127
 Sankara Ayyar, M. A., 49, 50
 Sapehin, A. A., 139, 141
 Sax, K., 93, 163
 Schantz, O. M., 278
 Schlicher, E., 111
 Schilder, F. A., 272
 Schwartz, C. D., 263
 Scott, G. W., 297
 Seeliger, R., 244
 Shamel, A. D., 256
 Shaw, F. J. F., 10, 18
 Shibaev, P. N., 156
 Shimura, T., 227
 Shuey, G. A., 114
 Shull, A. F., 98
 Shull, G. H., 90
 Simon, J., 149
 Singh, S. B., 51
 Singleton, W. R., 166
 Sinnott, E. W., p. 98
 Skazkin, F. D., 124
 Skovsted, A., 65, 66
 Slate, G. L., 264
 Smith, G. M., 170
 Smith, G. S., 152
- Smith, O. F., 179
 Snell, K., 125
 Snyder, E., 276
 Sorokina, O. N., 136
 Sosnovetz, A. A., 237, 238
 Sosnowets, A., see Sosnovetz, A. A.
 Steschina, N. A., 237, 238
 Stokes, I. E., 214
 Strampelli, N., 21
 Svetašev, A. T., 198
- Tansley, A. G., p. 98
 Thorold, C. A., 16
 Torrie, J. H., 155
 Tschermak-Seysenegg, E., 92
 Tsivin, V. N., 205
 Tu, C., 187
- U, N., 192
 Upcott, M., 83
 Uspensky, E. M., 195
 Uzembayev, E., 202
- Vacenko, A. A., 133
 Vasconcellos, J. de Carvalho e, 146
 Vavilov, N. I., 116
 Vears, C. K., 34, 40
 Velardez, J. G., 257
 Veruschkina, S. M., 138
 Vill, 283
 Vorobiev, A. I., 101
 Voss, J., 148
- Wakakuwa, S., 143
 Walther, E., 281
 Wanrooy, G., 301
 Waterhouse, W. L., 8
 Watson, R., 55
 Weihing, R. M., 180
 Weinberger, J. H., 253
 Wellington, R., 271
 Wiebe, G. A., 89
 Wilson, A., 155
 Woodroof, J. G., 275
 Woods, A. F., 105
- Yasui, K., 167

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